teachWELD™ welding simulation 123

EXPERIENTIAL LEARNING TECHNOLOGY

teachWELD Welding Simulation

User Guide *v.1035*

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teachWELD Introduction:

This manual contains information that is necessary for the proper setup and usage of the teachWELD simulator. Before setting up and usage of the simulator, please read through this manual.

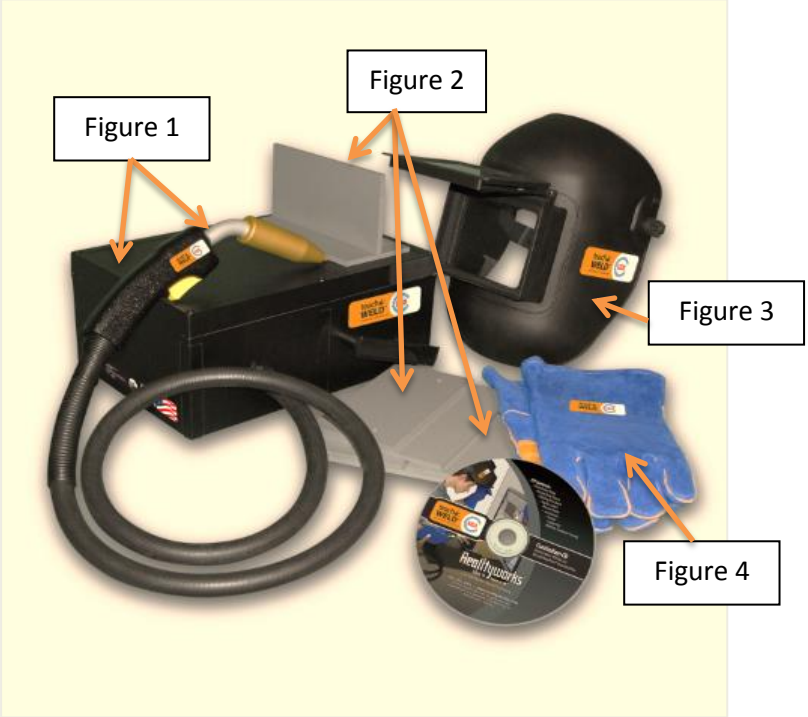
This manual is the main resource for all the installation, usage, and explanations of the various features of the teachWELD simulation. It is our intent to for you the user to be able to gain basic understanding of the teachWELD simulator and how to operate it accordingly. Not all welding terms are explained because this manual assumes that the user has some basic knowledge of the welding field.

teachWELD Simulation Components:

teachWELD Hardware:

The teachWELD welding simulation comes with one main hardware component and several accessories.

- The main welding component is the teachWELD workstation:
  - The workstation is comprised of a GMAW welding gun and a workstation welding box. (*Figure #1*)
- The accessories are as follows:
  - Welding Coupons (a t-joint, lap joint, & v-groove) (*Figure #2*)
  - Welding Helmet (with clear and colored lenses) (*Figure #3*)
  - Welding Gloves (*Figure #4*)



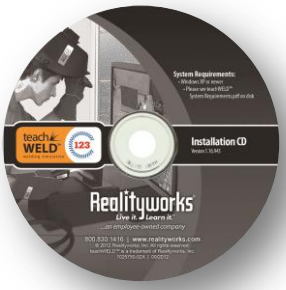
The coupons can be easily removed and replaced with the corresponding coupon guide that you are virtually welding on the software.

Note: *gloves and helmet are strongly suggested to be worn while using the simulation to replicate the correct feel of welding and to promote proper safety of welding for when they preform an actual weld.*

Attention: teachWELD hardware should not be in direct contact with any metal surface as metal can have an adverse effect on the welding simulator technology.

teachWELD Software:

The teachWELD welding simulation comes with two CDs:

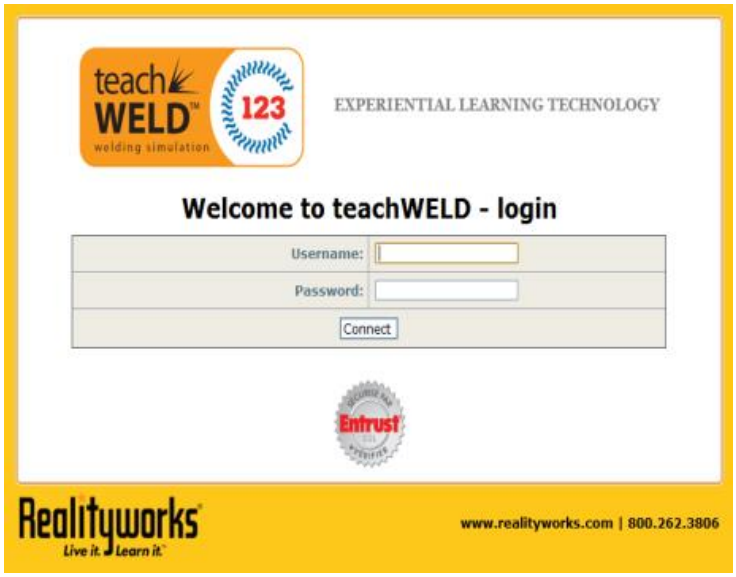


- **Installation CD:**
  - Please review the *teachWELD System Requirements* on the CD to ensure your computer meets the minimum requirements to avoid unexpected behavior when using the simulator.
  - To install the teachWELD software, insert the Installation CD and run the MSI installer. Directions are included in the installer.
  - This CD includes: *teachWELD User Guide*, *teachWELD Quick Start Guide*, and *teachWELD System Requirements.*

- **Curriculum CD:**
  - The Curriculum is comprised of 13 lessons on Welding Safety, Welding Defects, Welding Basics, and the teachWELD Welding Simulation.
  - Each lesson may consist of Presentation Slides, Notes, Fact Sheets, Worksheets, Quizzes, Projects, and much more.

teachWELD Instructor Site:

The teachWELD Instructor Site allows instructors and administrators of the teachWELD welding simulation to manage users and view student results. This site can be accessed from the web without the need for specially installed software.

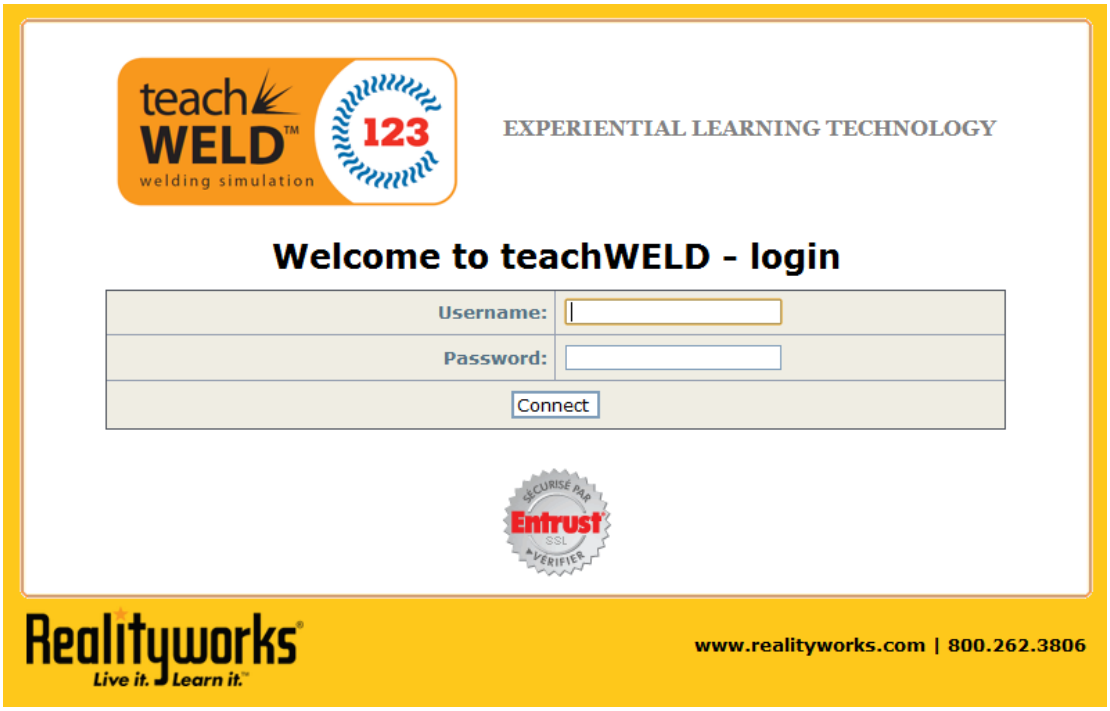


teachWELD Instructor Site

Adding Student Accounts to teachWELD System*

**Actual images are subject to change*

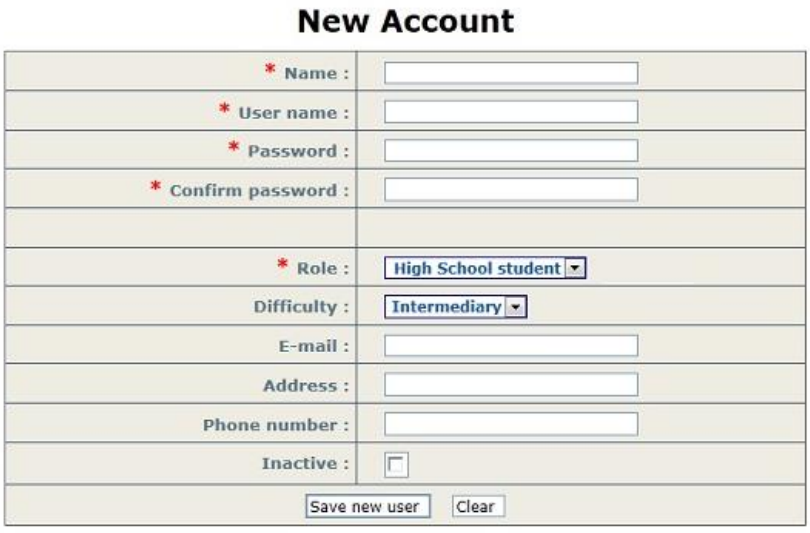
Step 1: Login to the system at the website contained within the information emailed to you by the Realityworks Product Support Team. If you do not have this information, please contact them at productsupport@realityworks.com.



Step 2: Use the administration menu, and click on the user management link.

Step 3: Click the "add new user" button in the user management screen.

Step 4: Enter the student's information and click "Save new user" to create the student account. Name, Username, Password and Role are required. (You can return here to edit a student account to change name, password, or difficulty. However, the Username cannot be changed after it is created.)

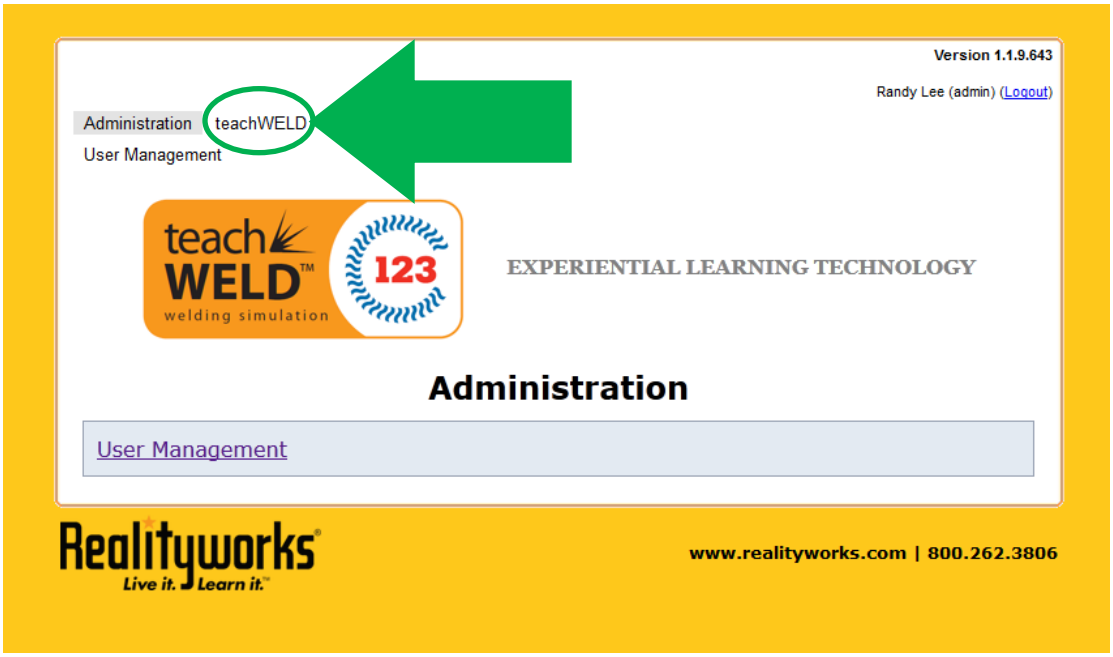


FINISHED! The new user is saved and has access to the teachWELD system. The new student will now appear on the user list.

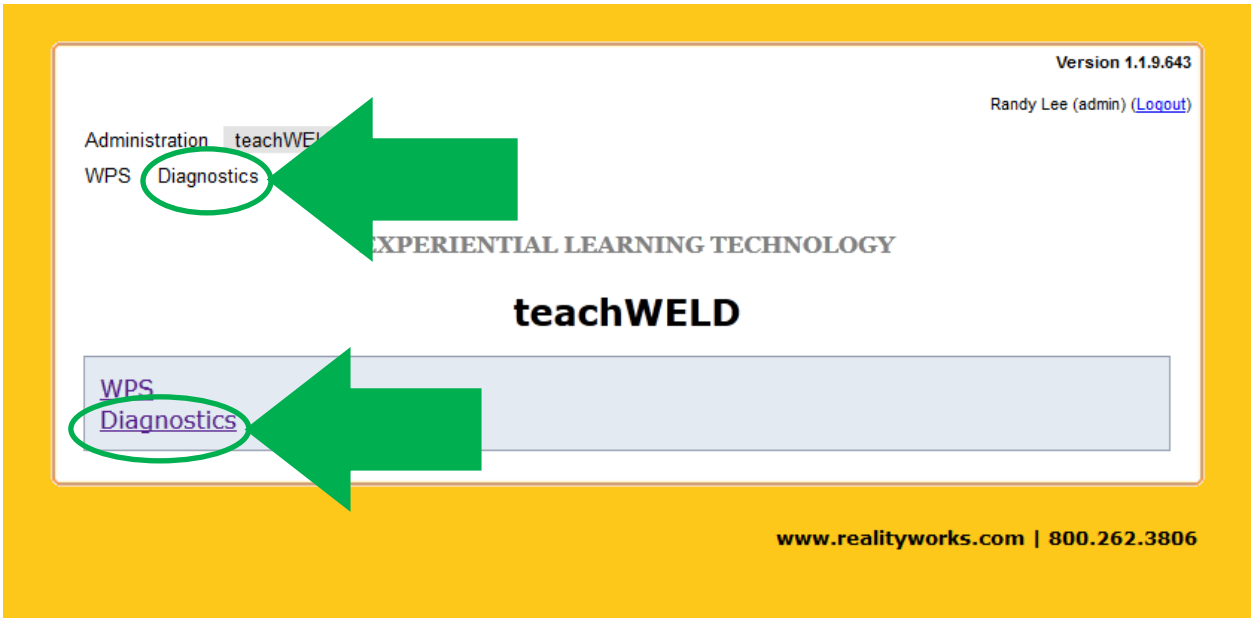
Access to Student Diagnostic Reports

Step 1: Login to the online system

Step 2: Click on the "teachWELD" link in the top left corner



Step 3: Click on the "Diagnostics" link at one of the two locations shown.



Step 4: The Diagnostics listing will show the most recent 10 diagnostic reports for each student (An and David in the example shown below). Each row shows a brief summary for each individual Diagnostic, with the Dexterity and Metallurgy scores found at right.

- To view the entire diagnostic report, click on the "Id" link and it will open in a new tab or window.
- Click "See complete list" to see a student's entire Diagnostic history.

Diagnostics

An

Id	Date	Process	Assembly	Base metal	Plate thickness	Dexterity	Metallurgy
24390	2012-08-03 12:16:59	GMAW	T joint (fillet weld)	Mild steel	6.4	81%	33%
24389	2012-08-03 11:02:54	GMAW	T joint (fillet weld)	Mild steel	6.4	94%	58%
24381	2012-07-27 13:36:37	GMAW	T joint (fillet weld)	Mild steel	6.4	79%	8%
23954	2012-07-26 16:34:54	GMAW	T joint (fillet weld)	Mild steel	6.4	90%	45%
23946	2012-07-26 16:31:04	GMAW	T joint (fillet weld)	Mild steel	6.4	80%	32%
23719	2012-07-26 13:47:21	GMAW	T joint (fillet weld)	Stainless steel	6.0	78%	65%
23575	2012-07-26 11:17:50	GMAW	T joint (fillet weld)	Aluminum	10.0	63%	37%
23559	2012-07-26 11:08:54	GMAW	T joint (fillet weld)	Mild steel	6.4	80%	33%
23386	2012-07-26 09:07:09	GMAW	T joint (fillet weld)	Mild steel	6.4	99%	71%
23091	2012-07-25 14:47:14	GMAW	T joint (fillet weld)	Mild steel	6.4	96%	73%

See complete list | View Progress

David

Id	Date	Process	Assembly	Base metal	Plate thickness	Dexterity	Metallurgy
23157	2012-07-25 15:20:37	GMAW	T joint (fillet weld)	Stainless steel	6.0	55%	31%
23152	2012-07-25 15:17:12	GMAW	T joint (fillet weld)	Stainless steel	6.0	80%	95%
21854	2012-07-20 06:46:15	GMAW	Lap Joint	Mild steel	6.4	88%	52%
21851	2012-07-20 06:45:06	GMAW	Lap Joint	Aluminum	10.0	95%	66%
21849	2012-07-20 06:44:18	GMAW	Lap Joint	Aluminum	10.0	95%	64%
21846	2012-07-20 06:43:19	GMAW	Lap Joint	Aluminum	10.0	86%	65%
21843	2012-07-20 06:41:45	GMAW	Lap Joint	Aluminum	10.0	76%	55%
21841	2012-07-20 06:41:00	GMAW	Lap Joint	Aluminum	10.0	75%	65%
21803	2012-07-20 06:15:46	GMAW	Lap Joint	Aluminum	10.0	71%	57%
21801	2012-07-20 06:14:57	GMAW	Lap Joint	Aluminum	10.0	78%	8%

See complete list | View Progress

Step 5: Click "View Progress" on the Diagnostic page to see a student's Exercise history broken down by assembly type, metal, and difficulty. Click on a link to see detailed information.

Progress Through Exercises

Back to user list

David

	Mild steel			Aluminum			Stainless steel		
	Beg.	Int.	Exp.	Beg.	Int.	Exp.	Beg.	Int.	Exp.
T joint (fillet weld)	0/17	**0/17**	0/17	0/17	**17/17**	0/17	1/17	**7/17**	0/17
Lap Joint	0/17	**0/17**	0/17	0/17	**17/17**	0/17	0/17	**0/17**	0/17
V-groove with backing plate	1/17	**0/17**	0/17	0/17	**17/17**	0/17	0/17	**0/17**	0/17

High Scores For Exercises

Back to progress summary

David

T joint (fillet weld) - Aluminum

	High score			Number of Attempts
	Beginner	Intermediary	Expert	
Exercise 1	0 %	**100 %**	0 %	3
Exercise 2	0 %	**87 %**	0 %	1
Exercise 3	0 %	**100 %**	0 %	1
Exercise 4	0 %	**100 %**	0 %	1
Exercise 5	0 %	**100 %**	0 %	4
Exercise 6	0 %	**100 %**	0 %	1

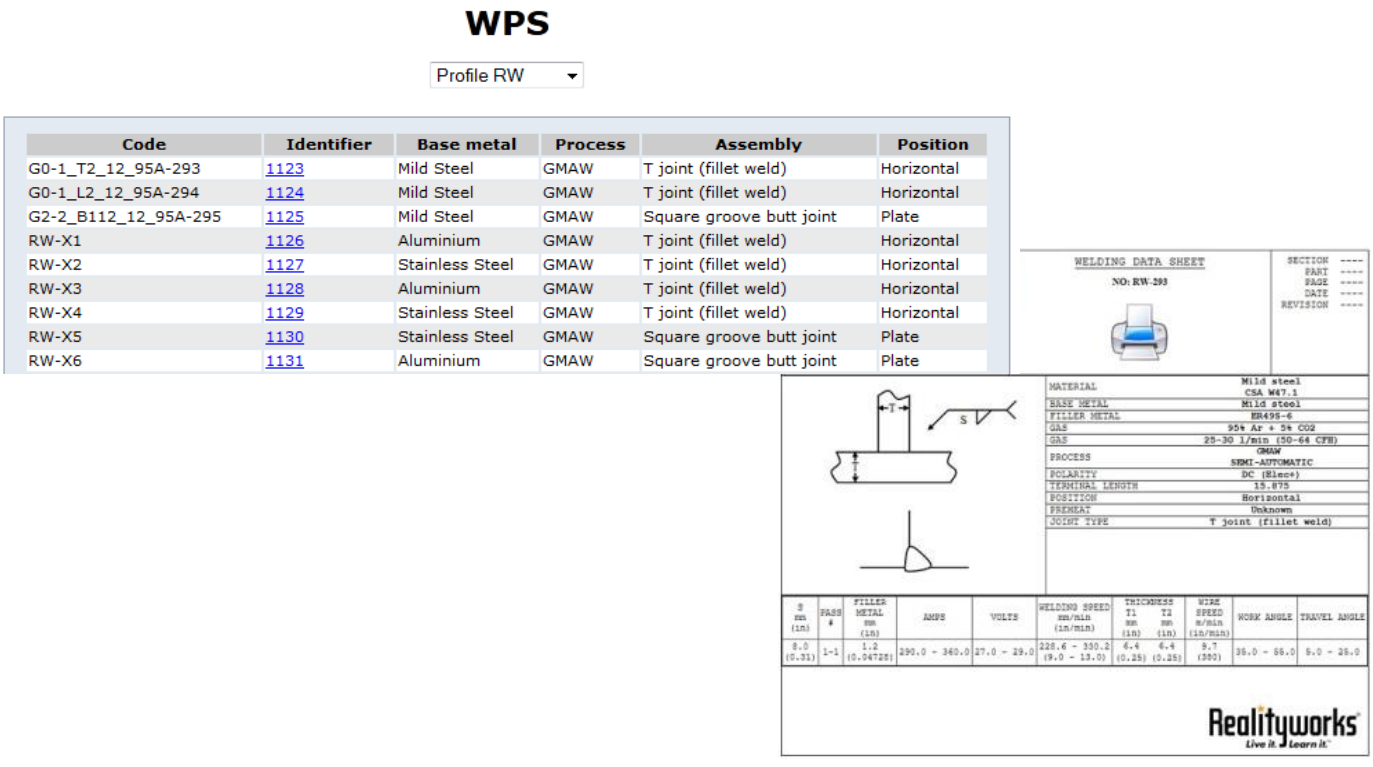
View the Welding Parameters Sheets (WPS) for all welding types

Step 1: Login to the online system

Step 2: Click on the "teachWELD" link in the top left corner

Step 3: Click on the "WPS" link at one of the two locations shown.

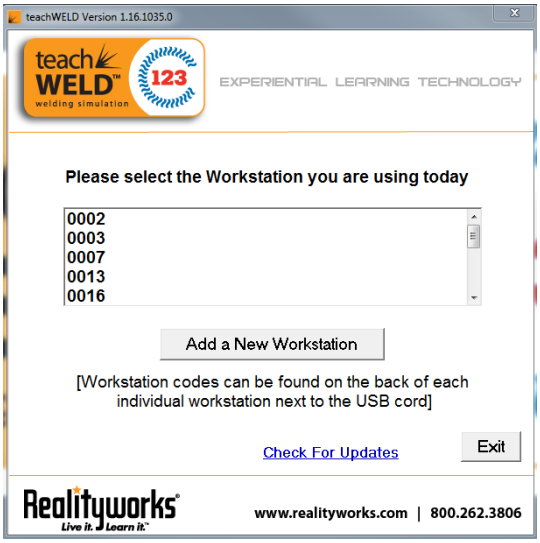
Step 4: The Welding Parameters Sheet (WPS) will show up with Identifiers, click on the linked numbers to see the specific Welding Parameter Sheet of interest.


WPS
Profile RW
Code | Identifier | Base metal | Process | Assembly | Position
G0-1_T2_12_95A-293 | 1123 | Mild Steel | GMAW | T joint (fillet weld) | Horizontal
G0-1_L2_12_95A-294 | 1124 | Mild Steel | GMAW | T joint (fillet weld) | Horizontal
G2-2_B112_12_95A-295 | 1125 | Mild Steel | GMAW | Square groove butt joint | Plate
RW-X1 | 1126 | Aluminium | GMAW | T joint (fillet weld) | Horizontal
RW-X2 | 1127 | Stainless Steel | GMAW | T joint (fillet weld) | Horizontal
RW-X3 | 1128 | Aluminium | GMAW | T joint (fillet weld) | Horizontal
RW-X4 | 1129 | Stainless Steel | GMAW | T joint (fillet weld) | Horizontal
RW-X5 | 1130 | Stainless Steel | GMAW | Square groove butt joint | Plate
RW-X6 | 1131 | Aluminium | GMAW | Square groove butt joint | Plate
WELDING DATA SHEET
NO: RW-293
SECTION ----
PART ----
PAGE ----
DATE ----
REVISION ----
MATERIAL Mild steel CSA W47.1
BASE METAL Mild steel
FILLER METAL ER495-6
GAS 95% Ar + 5% CO2
GAS 25-30 l/min (50-64 CFH)
PROCESS GMAW SEMI-AUTOMATIC
POLARITY DC (Elec+)
TERMINAL LENGTH 15.875
POSITION Horizontal
PREHEAT Unknown
JOINT TYPE T joint (fillet weld)
Realityworks
Live it. Learn it.

teachWELD Software Menu

Workstation Setup

To access the teachWELD welding simulation software, you must first install the software. Please look at the teachWELD System Requirements and Installation CD for more information.



Step 1: Launch the teachWELD software using the desktop shortcut ( ) or by browsing through the Windows Start menu to:

All Programs\Realityworks\teachWELD

NOTE – you can click the "Check for Updates" link on this screen to launch a browser window that will let you know if any updates are available for your software.

Step 2: Select the workstation you are using. Each workstation has a unique serial number printed on a label next to the USB cable on the back of the workstation.

The first time you connect a workstation to a computer, you will need to click the "Add a New Workstation" button, enter the serial number off the workstation, and click on "Add Workstation." (Figure A) This retrieves the Factory Default Calibration file for the workstation from the Realityworks server.

Figure A

Any subsequent time that you connect a workstation to a computer, click on the number that corresponds to the workstation you are using during this session to move to the next step. (Figure B)

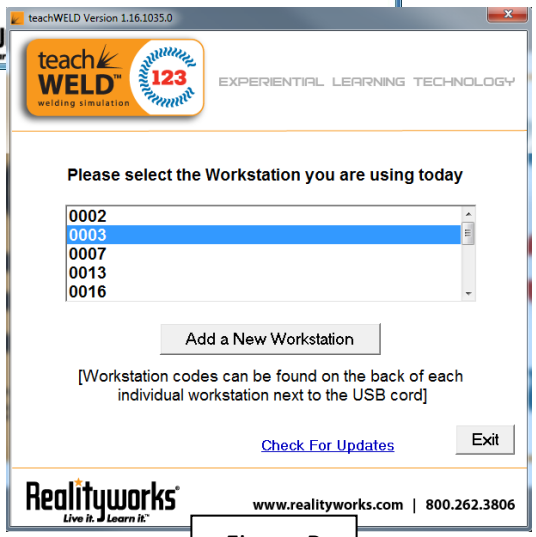


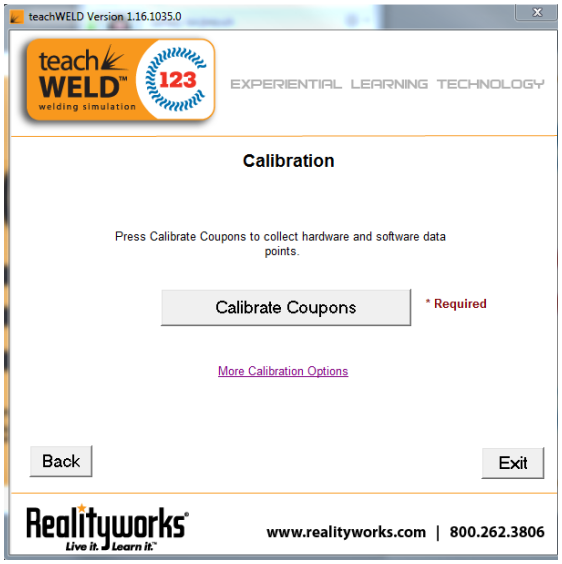
Figure B

Step 3: This screen (Figure C) shows up after you have selected the workstation. You will need to perform a coupon calibration. This will also be required when you select a different workstation than the one used in the previous session. Press "Calibrate" to continue.

Figure C

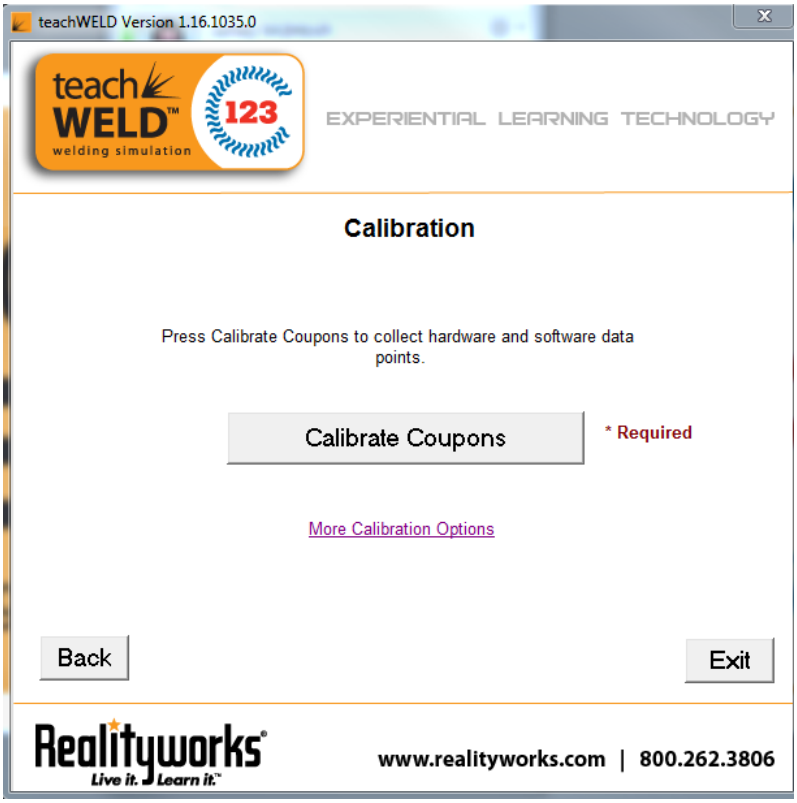
Step 4: Your screen will ask you to "Press Calibration Coupons to collect hardware and software data points." Click on the button that reads "Calibrate Coupons"

- **Coupon calibration** is the main user calibration required for successful use of the simulator.
- **More Calibration Options:** for troubleshooting precision issues – this allows you to reset your workstation calibration to factory default or recalibrate with Product Support help.



Calibrating Coupons:

Step 1: Click on the *Calibrate Coupons* button.



Step 2: After clicking on the *Calibrate Coupons* button, a new data screen will pop up. The next steps are performed with the welding gun.

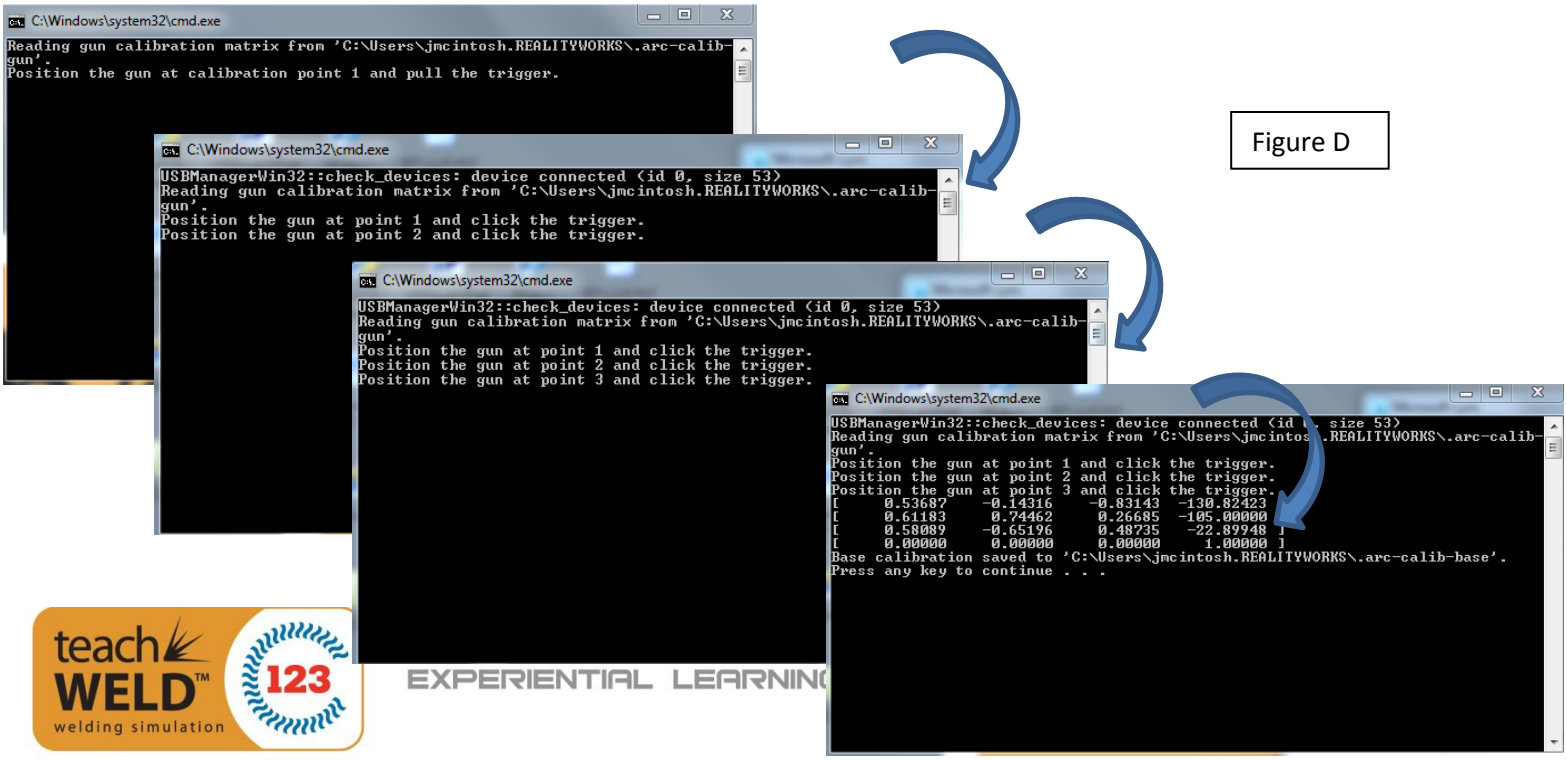

C:\Windows\system32\cmd.exe
Reading gun calibration matrix from 'C:\Users\jmcintosh.REALITYWORKS\.arc-calib-gun'.
Position the gun at calibration point 1 and pull the trigger.
C:\Windows\system32\cmd.exe
USBManagerWin32::check_devices: device connected (id 0, size 53)
Reading gun calibration matrix from 'C:\Users\jmcintosh.REALITYWORKS\.arc-calib-gun'.
Position the gun at point 1 and click the trigger.
Position the gun at point 2 and click the trigger.
C:\Windows\system32\cmd.exe
USBManagerWin32::check_devices: device connected (id 0, size 53)
Reading gun calibration matrix from 'C:\Users\jmcintosh.REALITYWORKS\.arc-calib-gun'.
Position the gun at point 1 and click the trigger.
Position the gun at point 2 and click the trigger.
Position the gun at point 3 and click the trigger.
C:\Windows\system32\cmd.exe
USBManagerWin32::check_devices: device connected (id 0, size 53)
Reading gun calibration matrix from 'C:\Users\jmcintosh.REALITYWORKS\.arc-calib-gun'.
Position the gun at point 1 and click the trigger.
Position the gun at point 2 and click the trigger.
Position the gun at point 3 and click the trigger.
[0.53687 -0.14316 -0.83143 -130.82423
[0.61183 0.74462 0.26685 -105.00000
[0.58089 -0.65196 0.48735 -22.89948
[0.00000 0.00000 0.00000 1.00000]
Base calibration saved to 'C:\Users\jmcintosh.REALITYWORKS\.arc-calib-base'.
Press any key to continue . . .

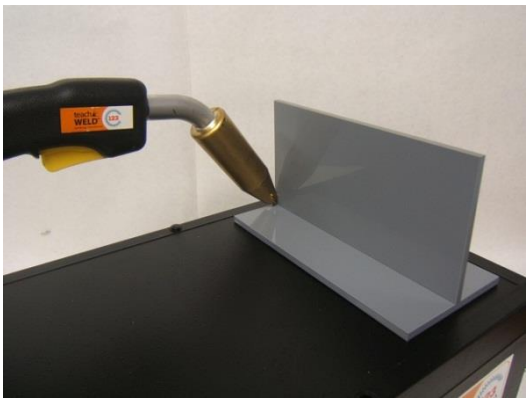
Figure D

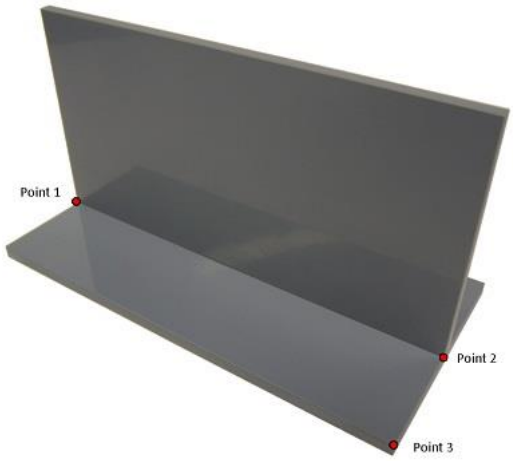
Step 3: Place the T-joint coupon on the workstation. Make sure the coupon it is fully seated on the workstation.

Step 4: Place the tip of the gun on the weld line on the far LEFT edge of the coupon. This is point 1. Hold the gun at a 45° work angle and a 0° to 15^0 travel angle. Pull the trigger.

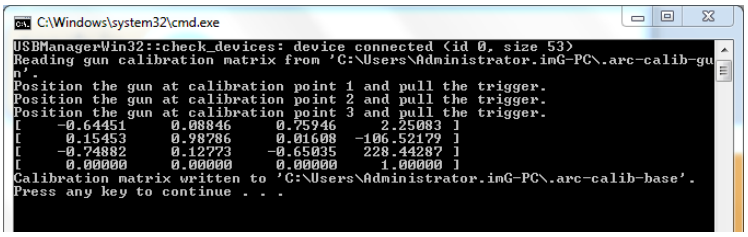
Step 5: Place the tip of the gun on the weld line on the far RIGHT edge of the coupon. This is point 2. Hold the gun at a 45° work angle and a 0° to 15^0 travel angle. Pull the trigger.

Step 6: Place the tip of the gun on the front far right corner of the coupon. This is point 3. Hold the gun at a 45° work angle and a 0° to 15^0 travel angle. Pull the trigger.





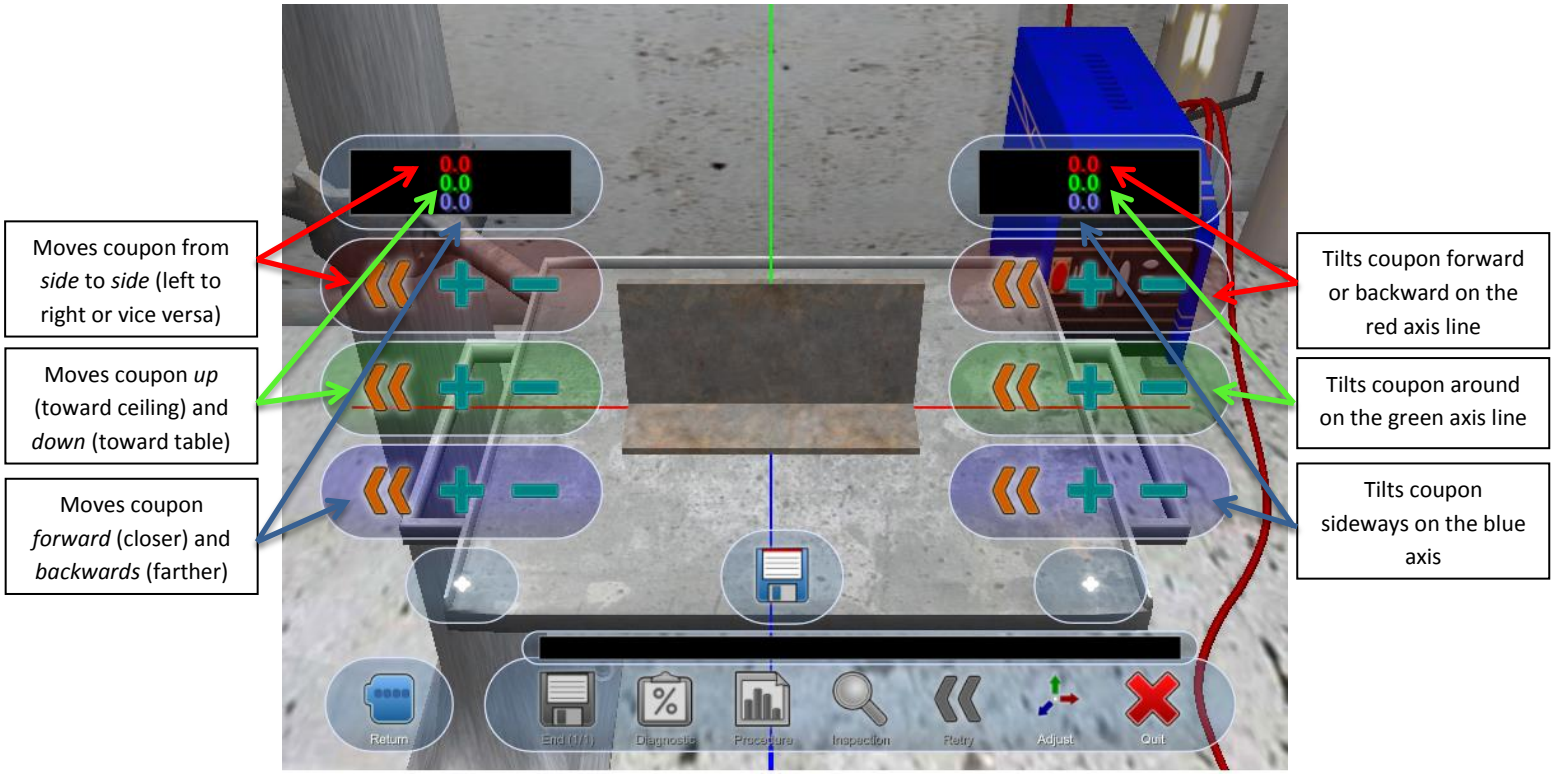
Step 3: The calibration data window will direct you to "Press any key to continue."


C:\Windows\system32\cmd.exe
USBManagerWin32::check_devices: device connected (id 0, size 53)
Reading gun calibration matrix from 'C:\Users\Administrator.imG-PC\.arc-calib-gu
n'.
Position the gun at calibration point 1 and pull the trigger.
Position the gun at calibration point 2 and pull the trigger.
Position the gun at calibration point 3 and pull the trigger.
[-0.64451 0.08846 0.75946 2.25083]
[0.15453 0.98786 0.01608 -106.52179]
[-0.74882 0.12773 -0.65035 228.44287]
[0.00000 0.00000 0.00000 1.00000]
Calibration matrix written to 'C:\Users\Administrator.imG-PC\.arc-calib-base'.
Press any key to continue . . .

NOTE: if you do not exit from this window, the main program will appear to hang. Return to this window and press any key to resolve this potential problem.

Software Coupon Adjustment:

Once you have logged into the teachWELD simulation software, you are ready to weld. If the physical coupon has some discrepancy with accuracy to what is being shown on the software or "virtual" coupon, you can adjust the coupon on your computer screen to align with the physical welding coupon.



NOTE: Due to the nature of virtual welding, after coupon calibration, you have the option to always remove the physical coupon from the teachWELD workstation and weld solely in the virtual world looking at your computer screen.

Calibrate Workstation:

NOTE – the Factory Default workstation calibration should work in most circumstances. This calibration should only be attempted if you are experiencing interference from metal, electronics, or magnetism in your use environment. *Only calibrate the workstation when you are troubleshooting precision issues with the teachWELD software.*

Step 1: Click on *More Calibration Option* on the Calibration page (Figure E), then click on the Calibration Workstation button. (Figure F).

Figure D

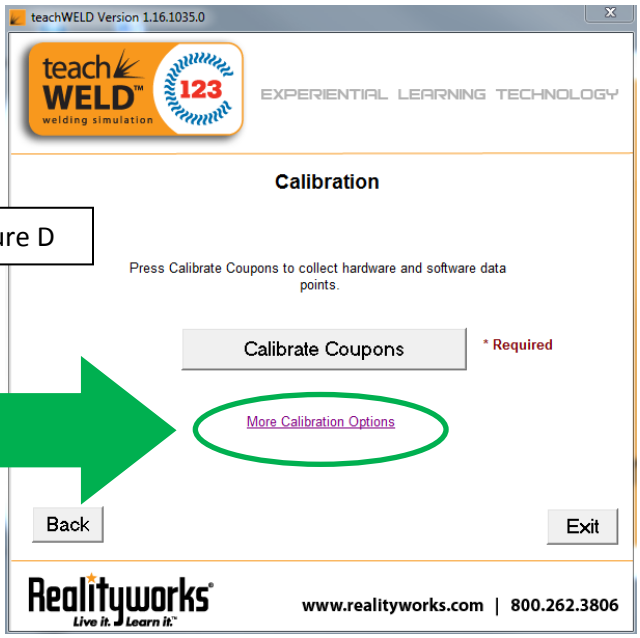
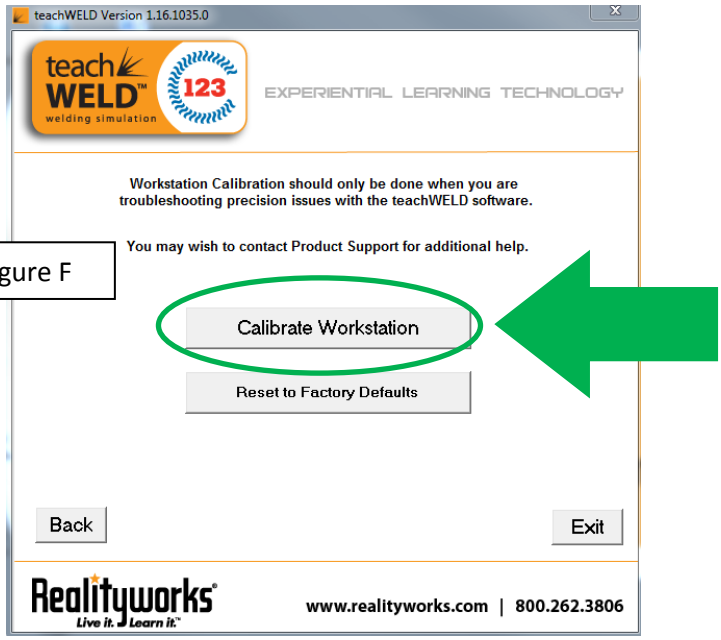
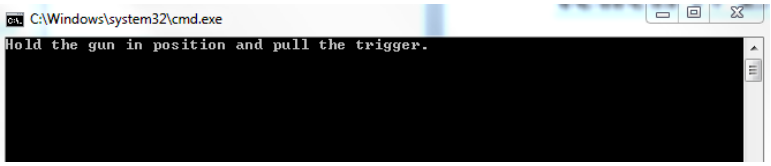


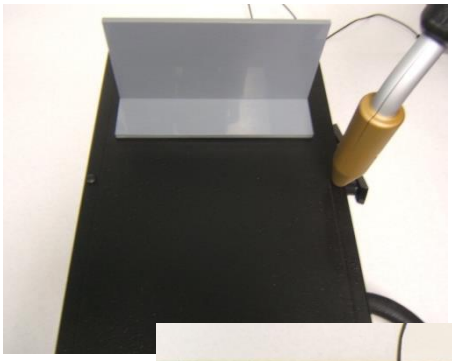
Figure F


teachWELD Version 1.16.1035.0
teach WELD 123
welding simulation
EXPERIENTIAL LEARNING TECHNOLOGY
Workstation Calibration should only be done when you are troubleshooting precision issues with the teachWELD software.
You may wish to contact Product Support for additional help.
Calibrate Workstation
Reset to Factory Defaults
Back
Exit
Realityworks
Live it. Learn it.
www.realityworks.com | 800.262.3806

Step 2: After clicking on the *Calibrate Workstation* button, a new data screen will pop up.

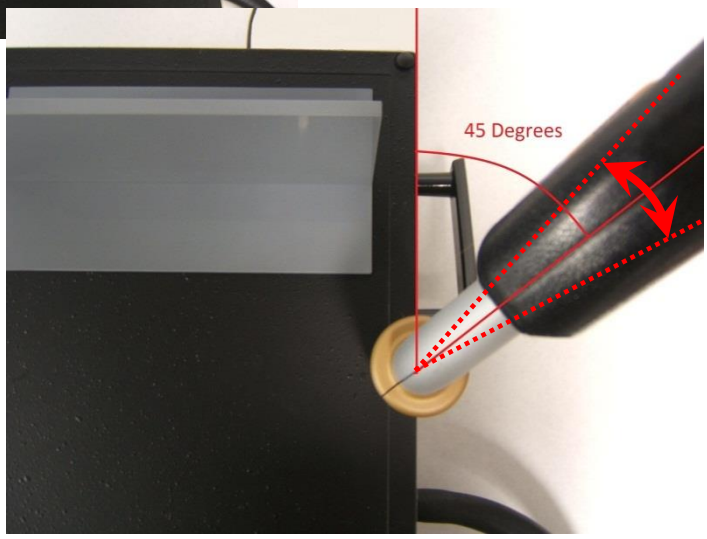


Step 3: Place the tip of the welding gun in the center hole on the top right side of the workstation. You may have to remove a plastic cap.



Front of Workstation (*look for Assembled in the USA sticker on the front of your workstation*)

Step 4: Hold the tip of the gun perfectly vertical as possible throughout this process.

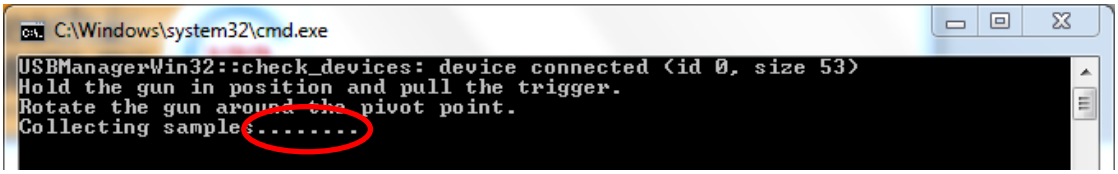


Step 5: Rotate the welding gun so the handle is pointing 45 degrees from the back of the workstation, as shown in the picture. This is the starting position for calibration.

Step 6: Press and release the trigger to begin calibration.

Step 7: Slowly rotate the gun assembly back and forth in a short arc – approximately 5 to 10 degrees, as shown by the dashed lines in the above picture.

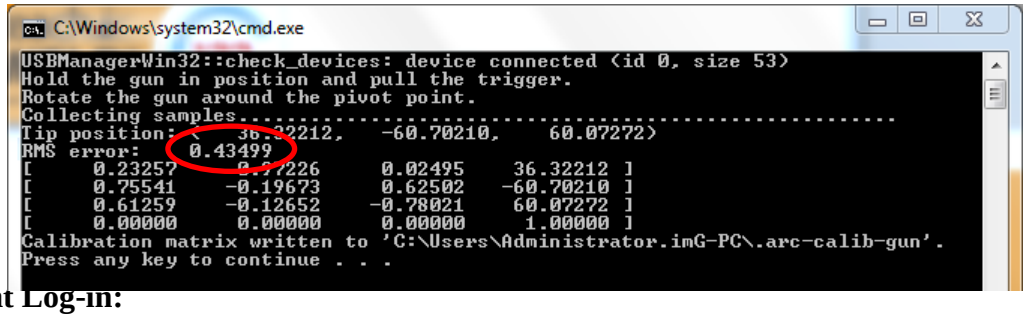
As you rotate the gun assembly, the line of "....." will grow from left to right." If you do not see this increasing, move the gun further. ***Note**: This process should take less than 1 minute.*


C:\Windows\system32\cmd.exe
USBManagerWin32::check_devices: device connected (id 0, size 53)
Hold the gun in position and pull the trigger.
Rotate the gun around the pivot point.
Collecting samples.....

Step 8: When the calibration matrix seen in the picture below appears, verify that the RMS error (circled in red) is less than 1.00.

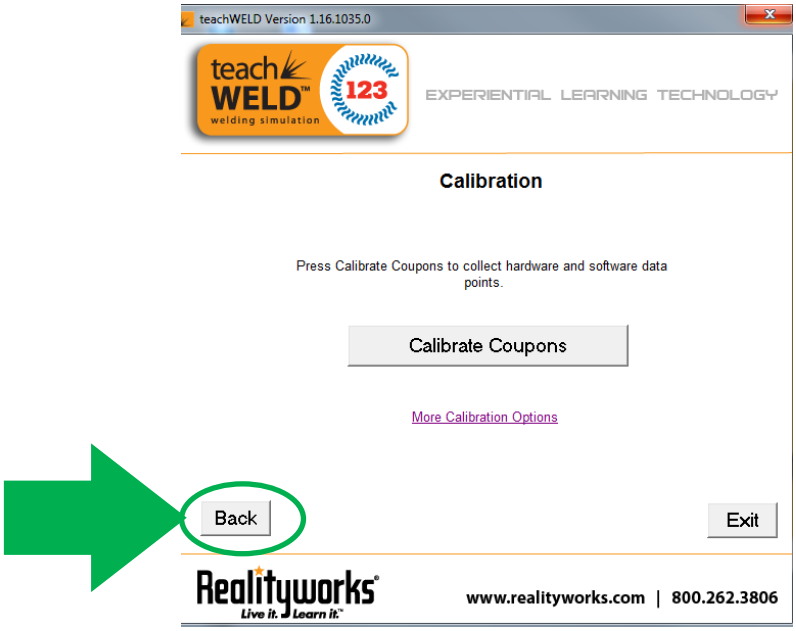
NOTE: If it is not below 1.00, your workstation will need to be recalibrated until you are below 1.00. Review the calibration instructions for proper calibration requirements. Otherwise, click any key to exit and continue.

NOTE – if you do not exit from this window, the main program will appear to hang. Return to this window and press any key to resolve this potential problem.


C:\Windows\system32\cmd.exe
USBManagerWin32::check_devices: device connected (id 0, size 53)
Hold the gun in position and pull the trigger.
Rotate the gun around the pivot point.
Collecting samples.....
Tip position: < 36.32212, -60.70210, 60.07272>
RMS error: 0.43499
[0.23257 0.97226 0.02495 36.32212]
[0.75541 -0.19673 0.62502 -60.70210]
[0.61259 -0.12652 -0.78021 60.07272]
[0.00000 0.00000 0.00000 1.00000]
Calibration matrix written to 'C:\Users\Administrator.imG-PC\.arc-calib-gun'.
Press any key to continue . . .

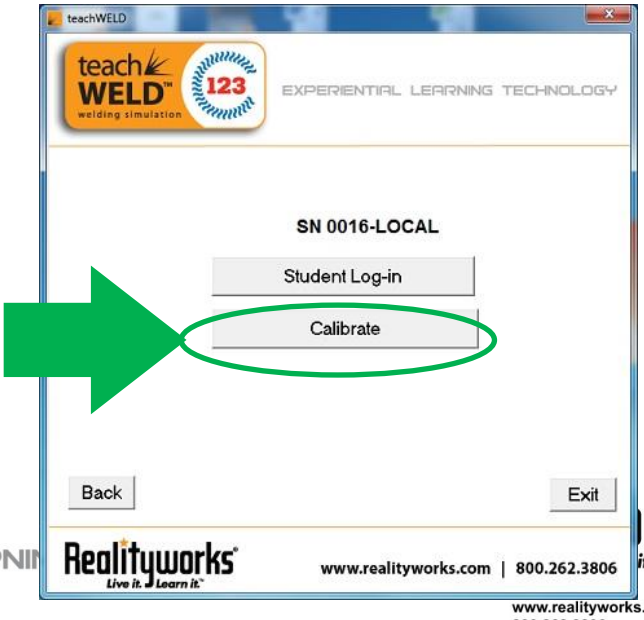
Student Log-in:

Step 1: Once you have performed the Coupon Calibration, click on the "Back" button to return to the Main Page.



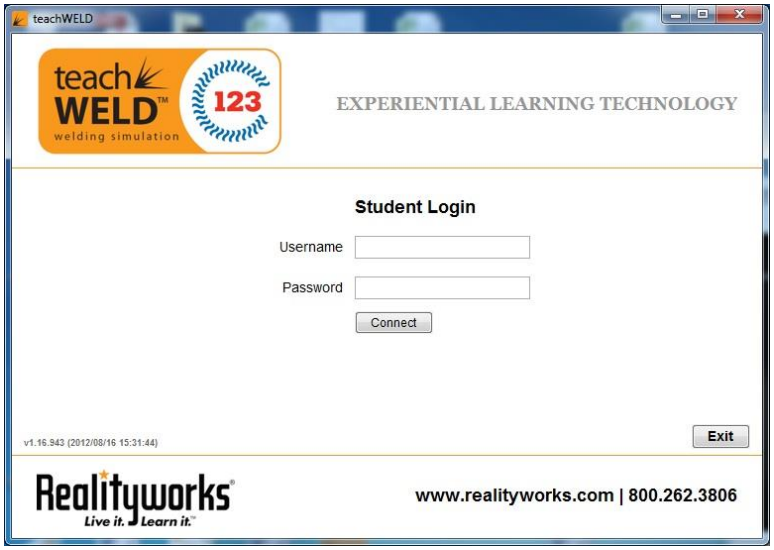
Step 2: The Student Log-in button should now be visible. Click it to continue.

If this button is not visible, you must click Calibrate and perform the Coupon Calibration to enable the button.



Step 3: The Student Login page will load in a new window. Enter your Username and Password and press Connect to log in.

You can also log in with your instructor username and password from this screen.



teachWELD Software Modes:

Mode Selection Menu:

You have 4 options from this main page:

- Click Disconnect in the upper right corner to log out and return to the Student Log In Page.
- Click on the Practice icon to practice your welding skills. In this mode, you can select any welding situation, adjust difficulty, and use dexterity guides.
- Click the Replay icon to view previous welds. In this mode, you can browse your weld history by date and see video-like replays as well as review diagnostic reports.
- Click on the Exercises icon to start or resume exercises. In this mode, you are guided through each datasheet in a gradual sequence, and must demonstrate 80% performance to complete each Exercise.

Welding Options Menu:

This will show up in the *Practice* and the *Exercise* section of the teachWELD simulation software.

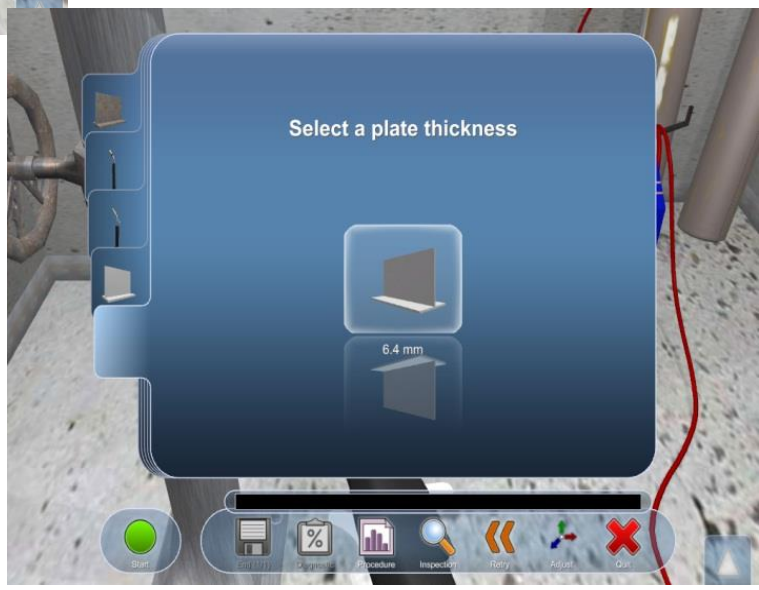
SELECT A BASE METAL:
The first window shows the choices of base metal. The base metal refers to the metal plate in the assembly, not the filler metal.

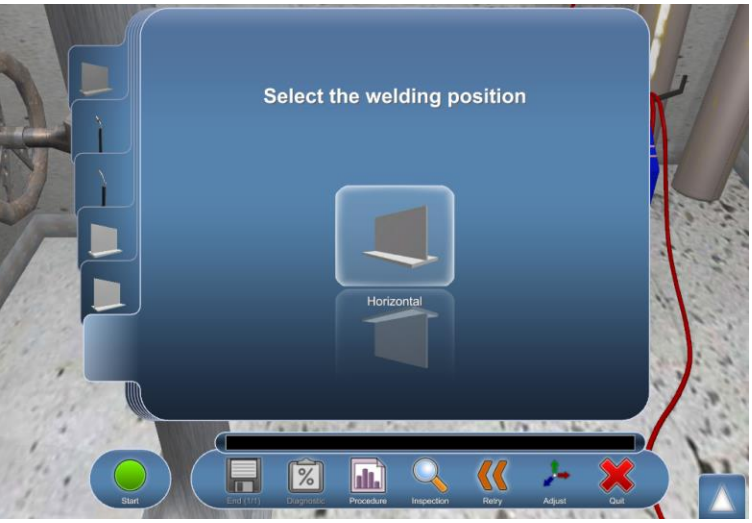
SELECT A WELDING PROCESS:
Depending on the selected metal, the GMAW process appears. The welding process shows which are the required markers and can affect certain functionality.

SELECT A GUN TYPE:
The welding simulation allows for three types of gun types to pick from. Default should be the Bernard.

SELECT AN ASSEMBLY TYPE:
The type of assembly refers to the configuration of the plates that form the assembly.

SELECT A PLATE THICKNESS:
In cases where there are plates of different thickness, the plate thickness refers to the main plate of the assembly. These vary based on metal type (stainless steel, mild steel, or aluminum).



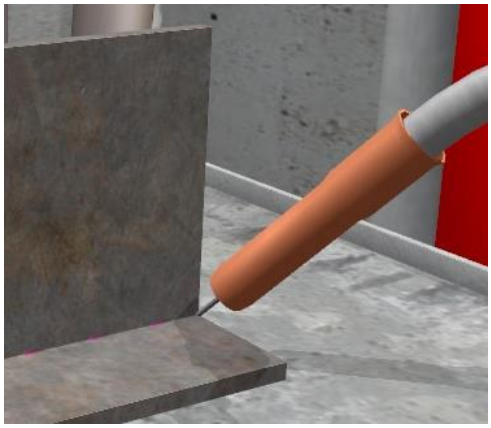


SELECT THE WELDING POSITION:

The position of the plate (really it is the assembly) represents your desired welding position. Depending on the type of coupon it will be could be horizontal or flat.

How to Weld:

Once you are ready to weld, bring the tip of the welding gun close to the plate and pull the trigger to start an electrical arc. Once metal is added, a deposit will be made and a seam will be formed. The screen will become very dark during this step, simulating the tinted lens of a welding helmet. By moving the arc, the molten pool will move by creating the seam behind it. When you cut the arc, the light comes back almost instantly and the seam freezes.



When the seam is frozen, it becomes solid and it is possible to weld on top of it. This is required in certain procedures when multiple, superimposed seams are required. This feature is called multi-pass. The methods used to create a seam vary depending on the process and on the type of base metal used. The GMAW processes use a gun that automatically applies the filler metal through the nozzle. In this method, simple press the trigger and the creation of the arc and the molten pool are almost instantaneous. It is important to keep the trigger pressed so that the intake or metal can be continuous and the arc can be maintained.

The arc will be cut in three ways:

1. The user ceases to press the trigger
2. The user tries to weld outside the plate
3. The distance between the plate and the nozzle is too great.

teachWELD PRACTICE

Practice Mode Overview:

This is the main mode of the simulator. It is possible to weld without any constraint in Practice mode. The toolbar at the bottom is always present and contains the main welding commands.

In this screen you will see most of the graphic items that make up the simulator, namely welding plates, the virtual gun, and after welding: the seams and the welding effects. The background workshop as well as the work plate is only presented to enhance the vision: these are only graphics and have no impact on the welding to be done.

The button at the bottom right of the screen is used to display the Main menu. If you activate it, the main menu will appear and take a portion of the screen.

Welding Toolbar:

The *Menu* button calls again for the welding parameters selection wizard. It is used to quickly change the settings for the next welding.

RETURN:

The *Return* button allows you to go back to the main screen of the teachWELD simulation. You will return to the *Mode Selection Menu*.

START:

The Start button is used from the Mode Selection Mode. When you have picked all your welding information, you can click on the start button to begin practice welding.

END:

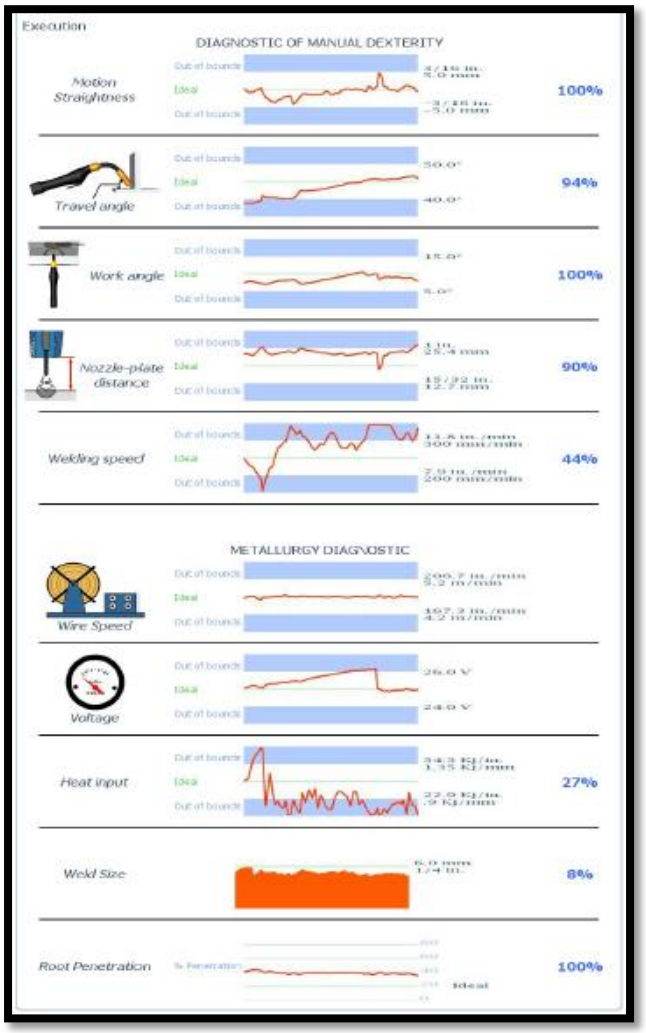
The *End* button allows you to save your weld. When you save your weld it will then save to the *Replay* mode of the teachWELD simulation. You will also be able to see the diagnostic report. The *Diagnostic* button will not be clickable until a weld has been done.

DIAGNOSTIC:

The *Diagnostic* button is available after the first pass has been completed. When activated, it will display the current welding score in a web browser.

DIAGNOSTIC REPORT:

The diagnostics is a webpage containing the results of a weld made in the simulation. There are two main categories for evaluation, the first relating to the gestures of the user during the welding, and the second relating to the metallurgical quality of the weld. To evaluate a weld, several criteria are taken into account in each category, and an average of these scores make up the final score in the category.



Diagnostic Scores:

Most of the scores are derived from the operational mode datasheets from the gesture data and mathematical formulas, aiming to approximate the best possible welding phenomenon of welding for the metallurgical qualities. While both are calculated separately, they are in fact interdependent; the welding is the result of the accuracy of the gesture, and the gesture is calculated by taking into account the parameters required to create a proper weld.

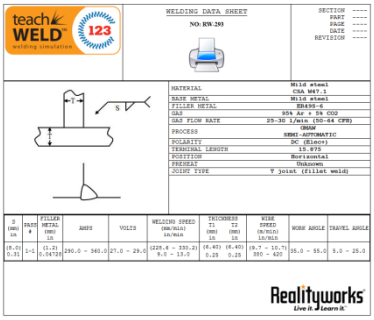
For the criteria for gesture, also known as manual dexterity, the guides mentioned in the welding mode section are indicators of each evaluation criterion. Each criterion has an ideal value and an acceptable variation, which may be different if you are over or below the value. Also, there is an option in the main menu and the welder profile where you can increase or decrease the margin of error by changing the difficulty level from beginner, intermediate, and expert.

Manual Dexterity	
Motion Straightness:	This value measures performance against the ideal positioning of the arc along the welding joint.
Travel Angle:	This criterion is the angle in which to lean the nozzle in the same direction as the path of the weld. On a horizontal plate, this corresponds to a left-right motion of the wrist. The simulator detects whether you push or pull the seam and adjusts its diagnostics accordingly.
Work Angle:	This is the angle of the nozzle perpendicular to the path of the joint. On a horizontal plate, this corresponds to an up-down motion of the wrist.
Nozzle-plate Distance:	This value determines what should be the ideal distance between the nozzle and the assembly. A nozzle too close or too far may lose points in this category.
Welding Speed:	To produce an adequate seam, there is an ideal travel speed calculated from welding parameters.
Metallurgy	
Amperage/Voltage:	Depending on the datasheet, these two parameters can be interchangeable, or only one of the two can be used. Both are measures of the electric arc (although not always equivalent depending on the datasheet).
Heat Input:	It is a calculation of the number of joules of thermal energy transferred to the plate in one second. This heat is responsible for the fusion of metal and the size of the seam among other things.
Weld Size:	Too much or not enough heat can adversely affect the weld. Also known as the height of the seam, it is the height of the seam from its center, usually located on the weld joint. By this height, the welder can infer many things about the metallurgy of the welding.
Root Penetration:	Depending on the angle of the gun in connection with the gap of the two metals, this will show how deep you would be able to penetrate into the gap and fill the seam.

PROCEDURE:

The *Procedure* button will display the operational welding mode or datasheets in a browser. Like the diagnostics button, it will appear after at least one pass is complete.

PROCEDURE DATASHEET:



A welding datasheet is a precise specification of an operation mode to achieve a weld. Generally it includes the disposition of the assembly, the metal type, the welding process, the desired metallurgical result, all according to a well-established welding standard. Each datasheet in the teachWELD simulation has been developed by a certification body or a qualified welding engineer. Some examples of these organizations are the *American Welding Society* (AWS), *The Canadian Welding Board*, and the *American Society of Mechanical Engineers* (ASME).

INSPECTION:

The *Inspection* button will toggle the simulator into inspection mode. This mode is used to inspect the welding area and move the virtual welding world to your desired welding perspective.

INSPECTION MODE:

The simulator allows a view of the scene. This makes a number of things possible, such as watching the seam very closely, having a stable camera, and having a field of vision that gives you the best view of your weld.

There are two control groups for the inspection mode, but you cannot go into inspection mode wherever you wish. Generally you can access the inspection mode with the *Inspection* button of the main option bar at the time when you are not welding. However, once a welding arc is created, it automatically switches off the inspection mode.

As soon as you enter the inspection mode, a few additional buttons will appear to the right of the screen. The top one indicates the camera, the middle one indicates zoom-in and the bottom one indicates zoom-out. The camera button repositions the camera to a neutral position, set back and viewing the plate toward the bottom. The zoom-in button moves the camera a little forward. The zoom-out button does exactly opposite. Please note that it is possible to move forward and backward endlessly in this way.

RETRY:

The *Retry* button removes all passes made and returns to the original welding status. If the welding has not been saved, a window will appear to confirm this selection.

ADJUST:

The *Adjust* button shows additional controls to further modify the spatial position of the welding assembly. Once saved, these changes are fixed. If a Student saves an adjustment, it will impact his/her view every time that student uses the simulator. If an Instructor saves an adjustment, it will impact all of the Students as well as any Instructors on their account. ***NOTE:*** this feature should only be changed by an administrator or for special situations. Use sparingly.

QUIT:

The *Quit* button returns to the Mode Selection Menu.

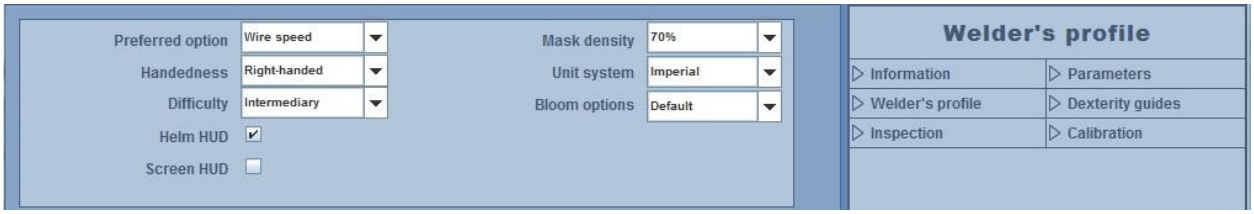
MAIN MENU:

The *Main Menu* button at the lower right will reveal an additional menu at the bottom of the screen, called main menu, because it contains most of the commands of the teachWELD welding simulation.

Main Menu:

The *main menu* is where most of the less-used commands of the simulation or those that could not be accessed on the main screen. It is divided into several submenus to better categorize the options. Each submenu will be described in detail.

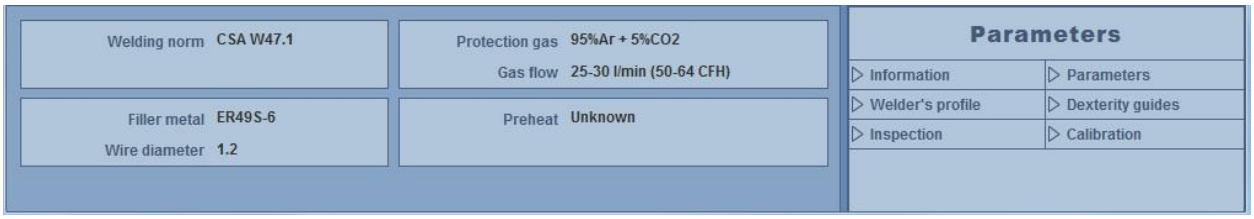
INFORMATION:



This submenu is the first visible menu of the main menu. It displays most of the current parameters of the gun and the weld itself, such as the wire speed (or amperage), the voltage, the arc deployment speed, the stick out, and both the travel angle of the gun and its work angle.

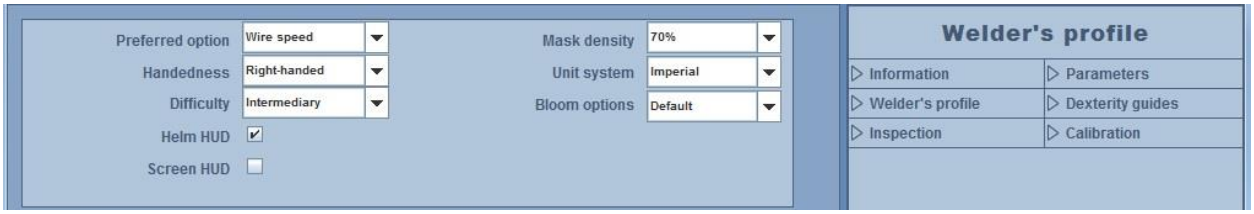
Only the wire speed (or amperage) and the voltage can be modified. The other information is for reference purposes only. The non-modifiable information includes the stick out, work angle, and travel angle, which will be updated along with the position of the gun in real time.

PARAMETERS:



This submenu shows some additional information about the currently loaded welding recipe. It is purely informative.

WELDER PROFILE:

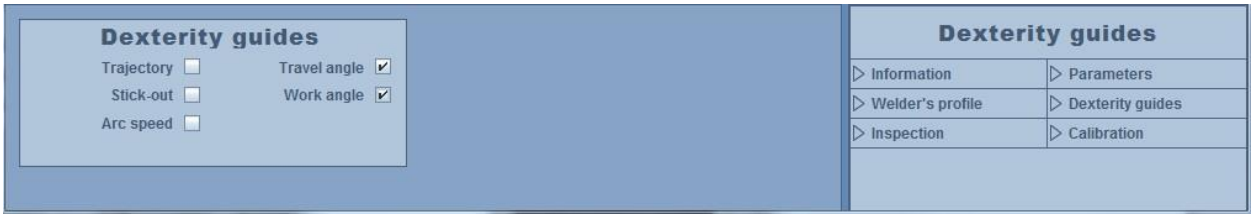


This submenu contains some easily modifiable options for configuring the simulator. Making modifications here gives faster access to some of these configurations, but the changes will not be permanent.

Here you can change the options from wire speed to amps, change the ease of implementation from left to right-handedness and vice-versa, change the difficulty of the current practice exercise and mask darkness. You can also set the unit system from metric to imperial.

The bloom options modify the lighting effects of the weld pool during welding. This is purely for graphic effect and does not affect weld diagnostics in any way. It may be used to better see the weld pool dimensions, but is cosmetic in nature.

DEXTERITY GUIDES:



This submenu contains the guides available to the user. Each can be turned on or off simply by checking or unchecking the box next to each guide (Examples of Travel angle, work angle and Arc Speed are shown below).

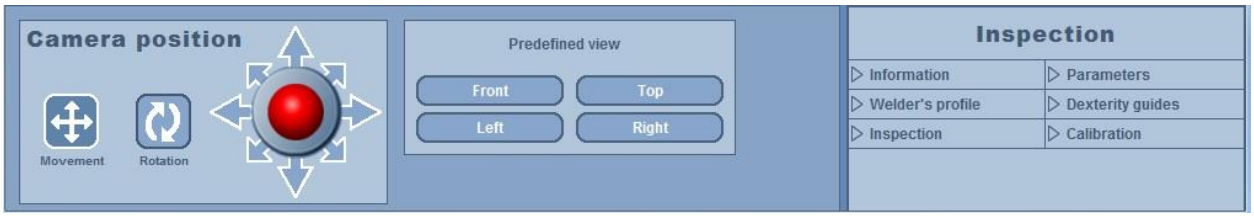
Guides like travel angle and work angle are shown above. When you are in incorrect position the red arrows will show and start to turn green and fade away as you move to the correct position.

Guides for arc speed will show up on the coupon itself with a green line for you to follow. If you are too far behind or ahead the green line will start to turn red showing you to either speed up or slow down.

The guides, activated in practice mode manually are indicators of the ideal movement that the user should follow. First of all, let us define the ideal movement. Every possibility of a plate in the simulator is linked to an operational mode datasheet. It is this association that makes the welding parameters as true as possible, because they are based on a method used in real life by certified welders. Included with this operational datasheet (in the simulation) is a set of criteria for the movements: the "perfect" work angle, the "perfect" speed and others. With these ideal parameters comes a margin of error. For example, if the angle of welding should be 45 degrees, the user can tolerate between 55 and 35 degrees to the upper and lower limits. It is on the values that the diagnostics rely in order to decide if the user misses points on this quality of movement.

In the profile of a welder, there is a variance in the level of difficulty. This variance affects the margin between the minimal, maximal and perfect values. The higher the level of difficulty, the more the margin of error shrinks. When possible, the guides try to reproduce visually this margin of error and/or to indicate the necessary corrections.

INSPECTION:



This menu is used to change the camera view.

1. Predefined views:
    a. The predefined views are a basic position for the camera (depending on the position of the assembly). The front view is somewhat set at a low angle, and the other three views are perpendicular to the center of the plate. Each view can then be modified to see something in more detail.
2. Camera position:
    a. The red button acts like a joystick that can interact with the touch screen by clicking and dragging. When activated, it can either move or turn the camera with an equivalent force to the distance to the original point of the joystick. The two buttons on the left of the joystick are mutually exclusive. One indicates that it is in the rotation mode, the other indicates the movement mode. You can also press the eight arrows around the joystick, but they can be more difficult to operate.

A rotation is a movement around a fixed point, as if one moved around a sphere. The point in question is always directly in front of the camera at the center of the screen (point of sight). In a movement, the camera and the point of sight move on a two-dimensional plane. Rotating the camera is similar to turning the head with the help of the neck, while standing still. For movement, you are moving your position while keeping your point of sight at the same place.

WORK ANGLE CALIBRATION:

This menu is used to fine tune the work angle calibration.

Step 1: To enable this calibration, check the Calibration box on the left side of the screen. This is the default setting.

Step 2: While holding the gun with the tip on the weld joint at the center of the T-joint coupon and the handle touching the front edge of the workstation, click the Capture button beside the Minimum number.

Step 3: While holding the gun with the tip vertical and touching the vertical plate of the T-joint coupon, click the Capture button beside the Maximum number.

This calibration should only be done if the reported Work Angle is different from the actual observed Work Angle.

Passes and Weld Finishing:

After a welding pass has been carried out, several things can happen. Most of them are automatic, but it is important to specify them here. To get the reports, you will need to click on the *End* icon to save your welding work.

Intermediate pass:

- A diagnostic report becomes available. It is possible for the user to view the exact result of previous passes as well as the overall score until now.
- The datasheet becomes available.

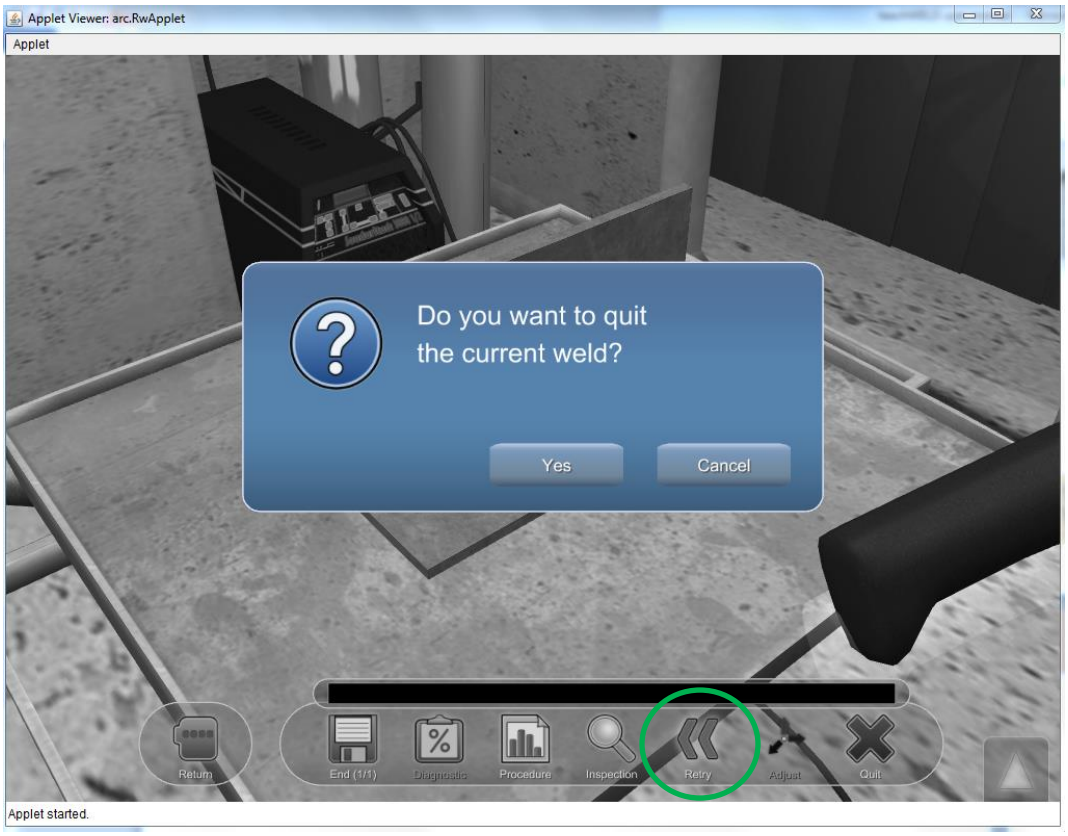
Final pass:

- All events of an intermediate pass occur.
- It becomes impossible to initiate another arc. The welding cannot be changed.
- The welding is saved and therefore can be viewed in the replay mode.

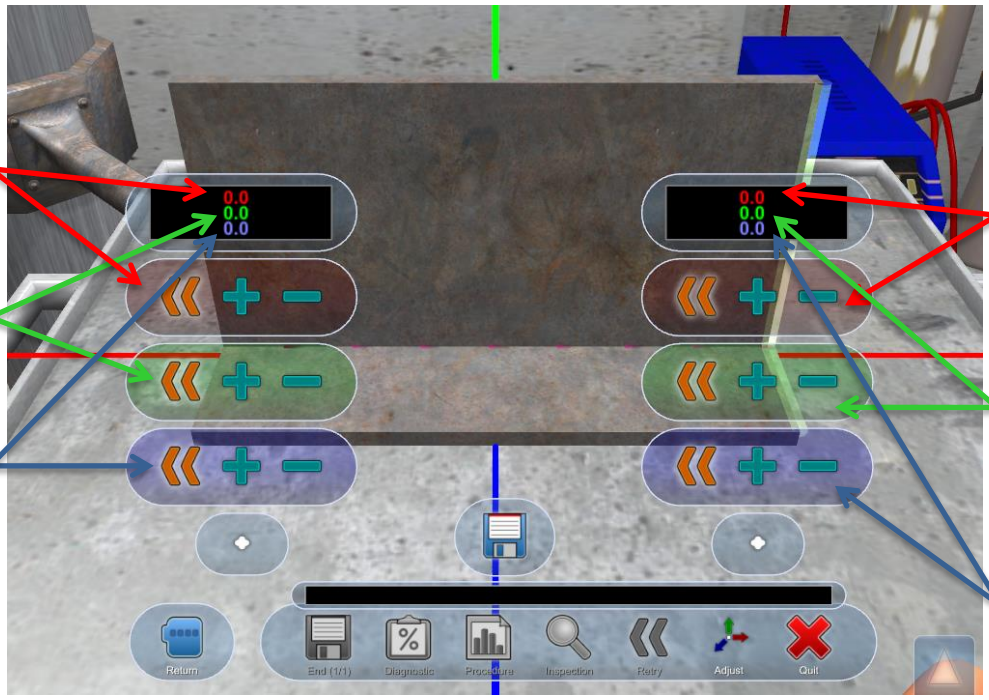
Retrying or Discarding a Weld:

When a welding has already begun, and the welder wants to either retry or change the welding parameters, you can retry a weld by clicking on the *Retry* icon. A message appears on the screen asking if you want to continue the action to cancel the welding already begun or if he wants to cancel the action and return to the welding.

The same screen appears when you want to go to the *Mode Selection Menu* while a welding is underway.



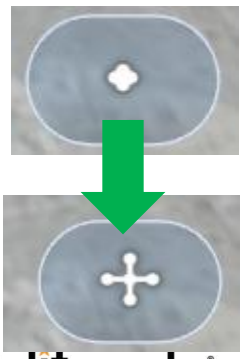
Spatial Adjustment of Assembly:


Red Line: Moves coupon left and right (side to side) along the red line
Green Line: Moves coupon up and down along the green line
Blue Line: Moves coupon forward and backward along the blue line
Red Line: rotates the coupon forward and backward around the red line
Green Line: rotates the coupon around (left and right) the green line
Blue Line: rotates the coupon around (vertically) the blue line
Return
End (1/1)
Diagnostic
Procedure
Inspection
Retry
Adjust
Quit

It is possible to modify the position of the welding assemblies in the *Practice* mode. If and only if no weld beam has been made, either just after having chosen a recipe or after a restart, you can access these controls by simply pressing the *Adjust* button. An Adjustment can correct for a coupon calibration offset within the program without having to close out and recalibrate. If a Student uses this feature, it will only affect their use of their simulator.

NOTE: This feature should not be used by the Instructor as any saved changes will affect any student users regardless of which workstation they are using.

There are two columns of controls and one central button to save. In each column there are three identical groups of three buttons each. These groups are color-coded and associated with a specific value for easy identification. A single button at the bottom is used to show or hide the controls. (Hiding a column lowers the visual clutter for easier viewing) When hidden, the button icon changes to represent the different state, as shown.

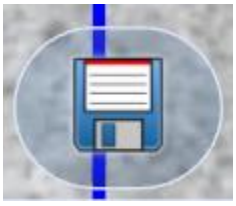


Each group of three buttons has the same purpose. These are assigned to a single value, which has the same color as the group's background. The first button, which looks like arrows pointing left, resets the value to zero. The second button, which

looks like a plus sign, is used to increase the value by a set amount. The third and last button, symbolized by a minus sign, decreases the value by the same amount. The set amount varies according to the column. The left column modifies the position and the right column modifies the rotation.

For position adjustments, the axis is invisible. This is because they are fixed no matter what the actual position or rotation values. There are three axis: while looking straight at the poster on the back wall, the first axis is left-right, the second axis is down-up and the third is away-towards yourself. Values are expressed in millimeters and changes one unit at a time. There is no way to show these values in another measurement system.

IMPORTANT NOTE:



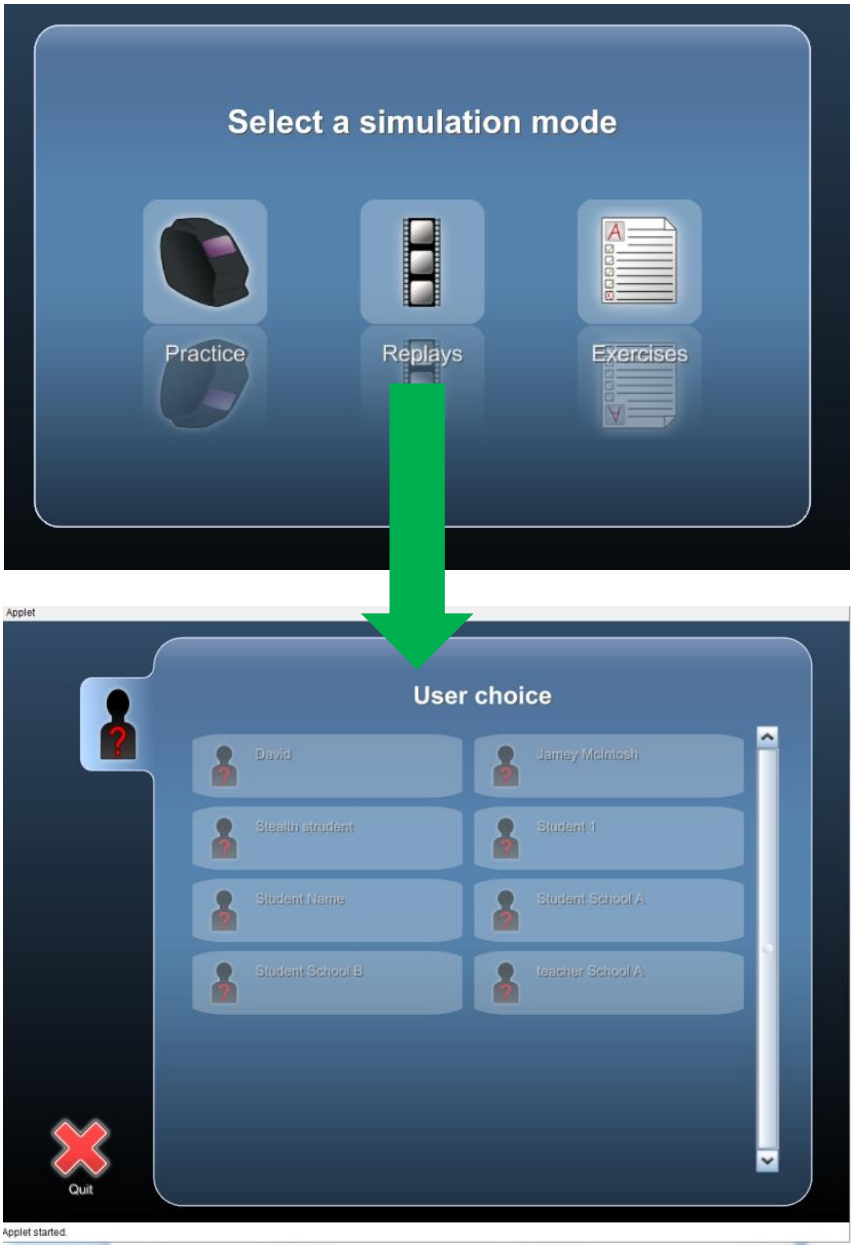
The middle button saves changes in the user's data on the server, thus making them **permanent**. If adjustment data is not saved, leaving the adjust mode by starting a weld or by clicking again on the Adjust button will reset all values to the last saved state. There is no easy way to reset all values except by sending them back to zero and then saving. Zero in all values is the default.

It is important to remember that all adjustments are unique to each recipe. They are not shared between multiple recipes, even very similar ones. Also, replays save the adjustments so there are not adverse effects changing the adjustments once a diagnostic and replay are saved using a prior adjustment.

teachWELD REPLAY:

User Selection Window – Replay Mode

(Administrator Only)



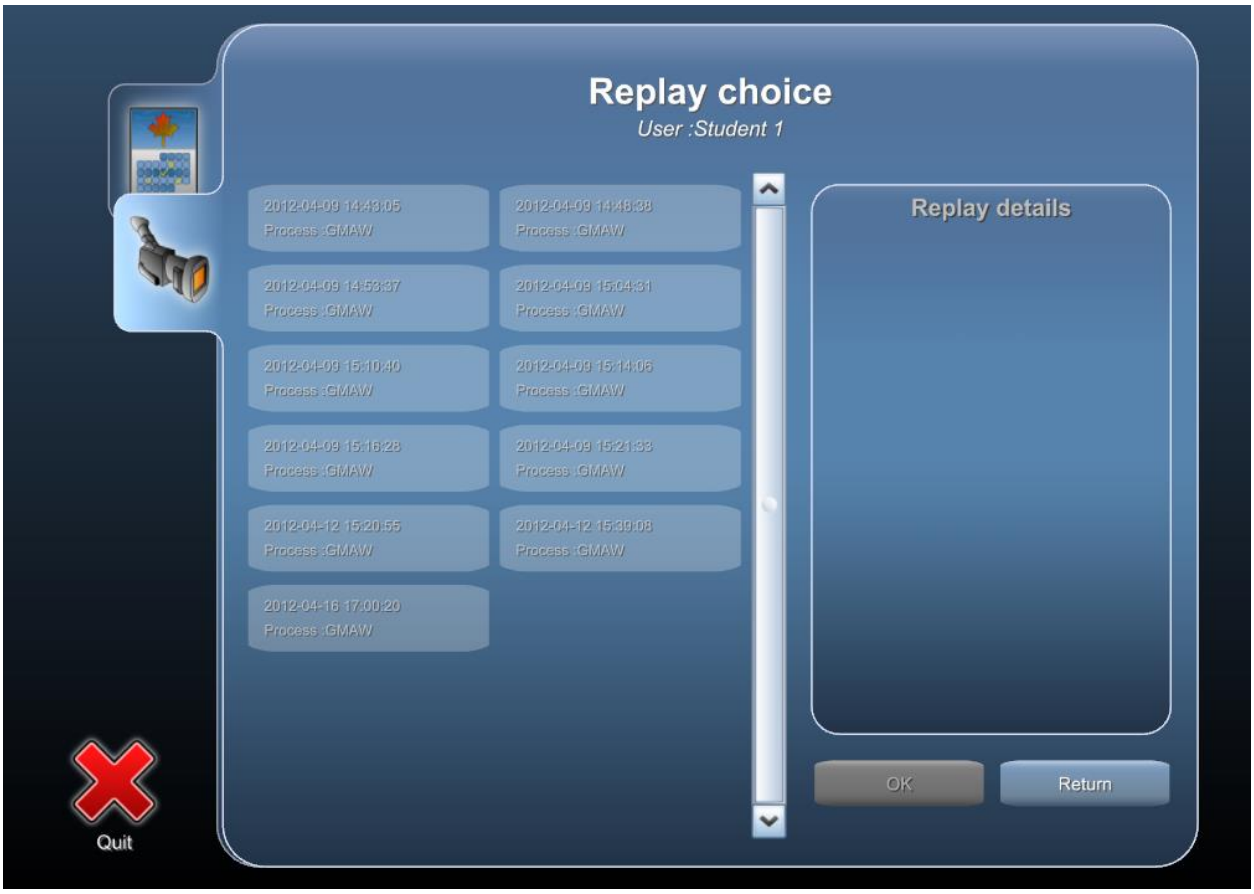
This window only appears if an authenticated user is a supervisor/administrator. It allows the supervisor to select the user for whom he would like to replay welds that the user made. All students and supervisors of the same profile will appear on the list. Once the user is selected, the time span selection window will appear and the rest of the procedure is then identical to that of a normal student.

Student View:

Time Span Selection Window:

In this window, you must select two dates. Both dates will be the time limits for searching the replays. You must pick a start date on the first calendar and an end date on the second calendar. You can change the month with the transverse arrows, but the time cannot be before the year of 2008.

Replay Selection Window:



Once the dates are selected, this window appears and displays all the replays that have been made between the dates specified in the previous window. Simply click on a date to select and view the information displayed on the right side of the screen. If you want to play a selected replay, simply click the *OK* button to go to the main screen of the replay mode. In the event that you wish to go back and choose another date interval, click on the tab of the previous window identified by a calendar.

If you want to return to the Mode Selection Menu, click the *Return* button.

If no replay is available, either due to incorrect date selection or simply because no replay exists in the selected date interval, the left part of the screen will be blank with an explanatory message. An additional back button will display there. At that time, you can either go back to the mode selection menu or select a new date interval by clicking on the calendar.

Replay Mode:

The Start button plays the replay and will be replaced by a pause button when activated.

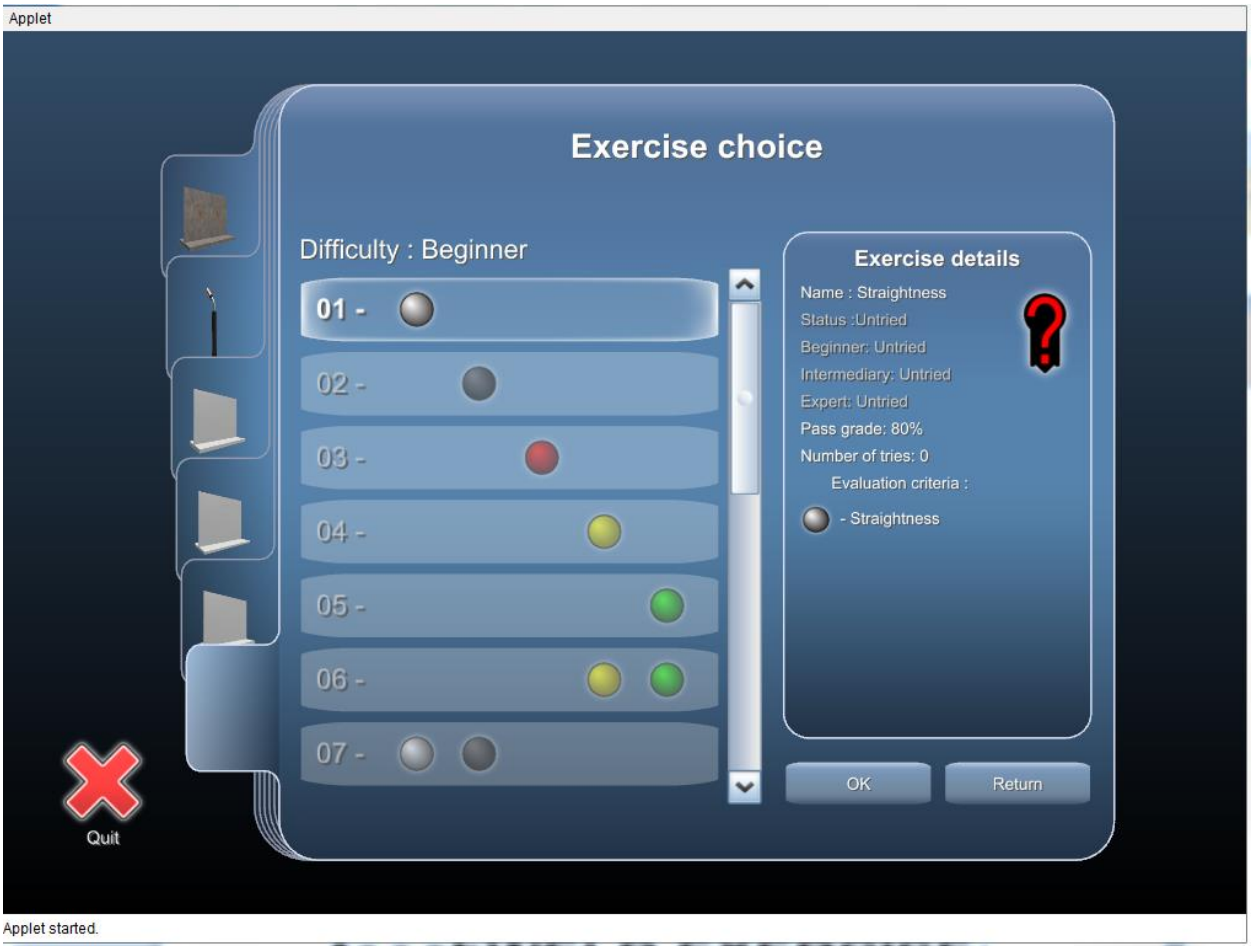
All other buttons work exactly the same as in Practice Mode. (see Practice Mode for details)

The In loop button allows automatic restart of the replay once it is finished.

The replay mode allows you to view previous welds made by users on the simulation. A weld is saved automatically when a user completes their pass and saves the weld. The replay will cut off unnecessary movements of the gun and weld when no welding is taking place. This can eliminate idle time and reduce the size of the replay. Once the replay is chose, a screen very similar to the one on the welding mode will be displayed. It will be impossible to weld. Here you can only view the replay from the beginning. You are unable to access the Main Menu at this time.

teachWELD EXERCISE:

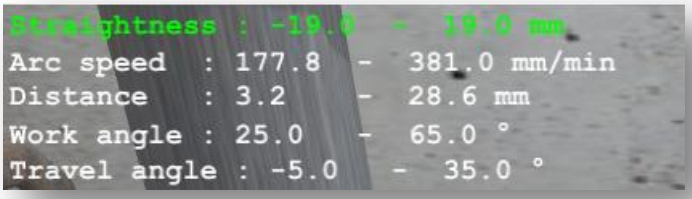
Exercise Mode:



This mode allows you to practice certain particular aspects of the simulator concerning manual dexterity. Some datasheets are activated to serve as a model for the exercises, and each is divided into 17 separate tests. The supervisor can choose which operation sheets of the practice mode are available for the exercises.

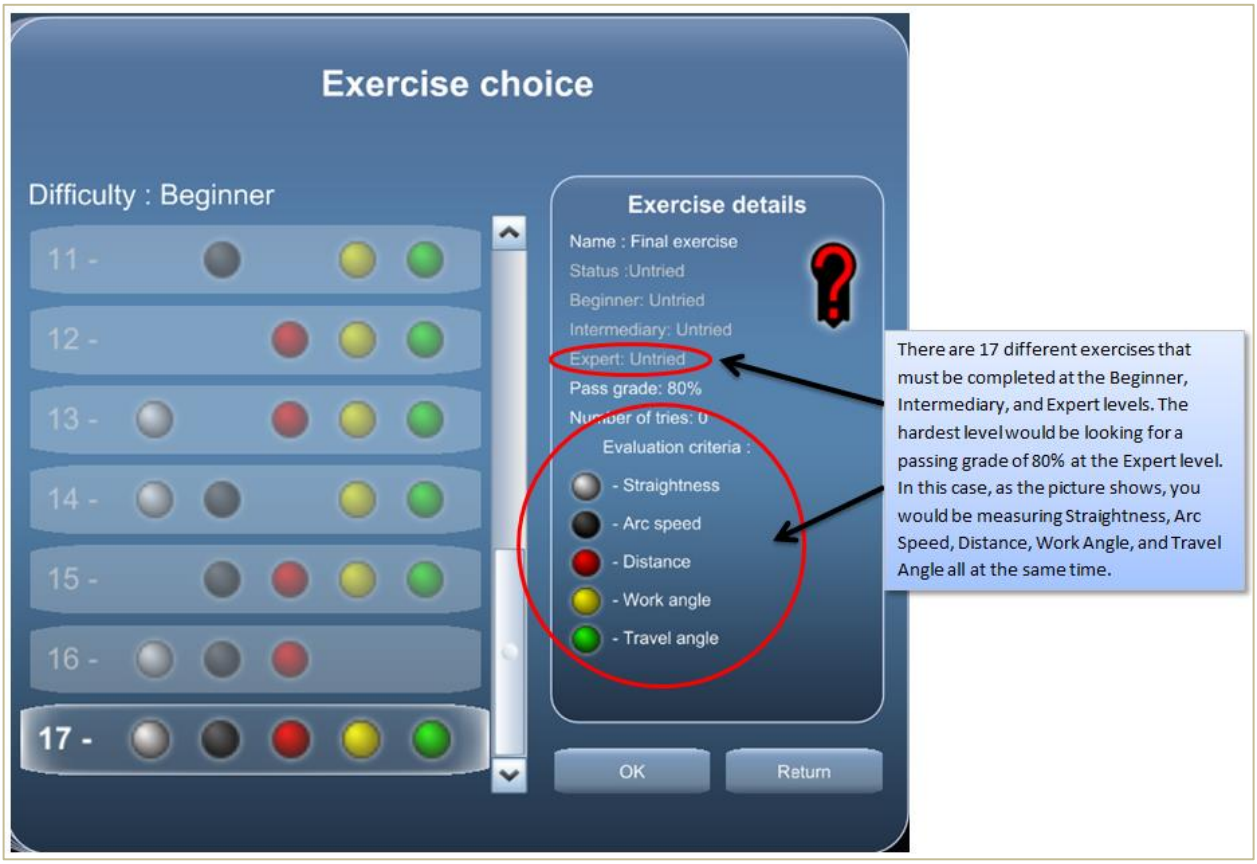
To help the user, each exercised is based on one or more elements that are assisted by a particular guide. In the more advanced exercises, more than one guide will be activated at one time.

The selection of exercises is similar to the practice mode, except that only the datasheets associated with exercises will be displayed. The displays will correspond with the beginner, intermediate, and advanced states of the exercises.



Exercise Grading:

When a weld is finished in this mode, a diagnostic and a replay are saved as in the practice mode. However, an exercise is not considered successful unless the parameter that exemplifies the manual dexterity has been as least 80% success, which makes some tests very difficult to succeed at, particularly the last one because it affects all of the criteria for manual dexterity simultaneously. The overall score for the exercise is the average of all the related scores, but even if the average is higher than 80%, the exercise can be considered successful only if each point has earned at least 80% individually.


Exercise choice
Difficulty : Beginner
11 -
12 -
13 -
14 -
15 -
16 -
17 -
Exercise details
Name : Final exercise
Status :Untried
Beginner: Untried
Intermediary: Untried
Expert: Untried
Pass grade: 80%
Evaluation criteria :
- Straightness
- Arc speed
- Distance
- Work angle
- Travel angle
OK
Return
There are 17 different exercises that must be completed at the Beginner, Intermediary, and Expert levels. The hardest level would be looking for a passing grade of 80% at the Expert level. In this case, as the picture shows, you would be measuring Straightness, Arc Speed, Distance, Work Angle, and Travel Angle all at the same time.

Multiple attempts at the exercises:

Each exercise can be attempted an unlimited number of times, whether successful or not. The simulator saves in its memory several statistics concerning each exercise. First, the description indicates whether an exercise was attempted, successful or failed, for each level of difficulty. An appropriate color lights the button representing the exercise, as well as to represent the status. Secondly, it retains the highest score achieved according to the level of difficulty, which is displayed in the description of the exercise. Thirdly, the number of attempts, failed or successful, is also displayed. Fourthly, the criteria evaluated for each exercise are also displayed.

Note that the number of attempts and the best score are updated even after the exercise has been successful. In the case of an exercise with multiple points to check, the highest score is always the average of the attempt that has the highest average for its manual dexterity diagnostics.

Replay an exercise:

There is no higher score than the one that is kept in the memory; there is also the replay of the highest score that is saved. So if at least one attempt has been made on an exercise, a replay is saved and is available for viewing. To do this, select an exercise that has at least one test, and click above it (the button should be green). At this time, instead of launching the exercise, you can press the button labeled as "View better replay". The *Replay Mode* interface will appear and you can view the attempt at the exercise. The features are the same as in the replay mode. The replay is chosen based on the scores and level of difficulty. In case of similar or even lower score if the exercise is successful, the simulator will choose a higher level of difficulty.

GLOSSARY:

Camera: Position of the view in the virtual space.

Datasheet: Sheet describing a formal method and the welding parameters to use. In this document, it is our own model for welding recipes

Diagnostic: Evaluation document of a virtual welding.

Disconnect: Action to return to the user selection menu.

Electric arc: Small flash occurring during welding.

Exercise: Welding where only certain criteria are evaluated, with or without the help of the guides.

Joint: Section of an assembly where a welding

Marker: Reflecting ball used by the motion capture system.

Nozzle: Front part of a welding gun through which the filler metal passes. Some welding guns do not have one.

Pass: Adding a welding seam on a joint.

Practice: Option to choose your own welding parameters to use.

Replay: Option to view a previously made saving.

Trigger: Located on the welding gun, the trigger allows the beginning of the electric arc.

Zoom: Operation to move the camera in the virtual scene.

Troubleshooting

The virtual gun does not follow the actual movements of the gun. The detection is imperfect.

To make the detection of the gun and other items perfect, make sure that the environment surrounding the simulator is adequate. Metal objects (even pop cans or coffee mugs) can cause interference with the workstation technology. The calibration of the coupons could also be off. (This can happen if you have started the workstation cold and after about 20 minutes it has warmed up, causing a recalibration of the coupon on the technology). In this case it is best to recalibrate the coupon first to correct the problem. A last resort is to recalibrate the workstation, but this should only be done after you have tried to recalibrate the coupons.

The arc does not initiate when you press the trigger.

First, check whether or not the gun is virtually hitting the coupon. Depending on your angle of view, it may look like you are hitting the coupon and actually just shy of the coupon. The trigger should only work when it is in contact with the virtual metal.

The entered password is always incorrect.

Contact Realityworks product support at 1-800- 830-1416 or productsupport@realityworks.com.

The "Save" button does not work.

For the save button to work you have to have welded over 80% of the joint on the coupon when in the Practice or Exercise modes.

The "Diagnostics" button does not work.

Have you pressed the "Save" button? For the "Diagnostics" to work, you must first save the weld to be able to have a diagnostic report. You must also have a working internet connection as the report comes from the matrix that is found on the internet. If you do not have an internet connection, you will not be able to retrieve a report.

The Simulation screen turns red when welding rather than dark grey or light black.

Due to the high volume of graphics that the teachWELD welding simulation uses, it needs to have newer technology and drivers on the computer. The red color during welding will not disrupt the weld in any way with the change in color. If you need more information see the teachWELD System Requirement Sheet or contact Realityworks product support at 1-800-830-1416 or productsupport@realityworks.com.

The virtual gun is not showing up at all.

Make sure the hardware gun is close enough to the coupon so that the sensors of the welding gun can show up on the software. If you have the gun close to the hardware coupon and it still is not showing up, make sure that the USB cord of the workstation is connected to the computer. You may need to check and make sure that you have added the workstation to the teachWELD workstation setup (see page 13). Check the serial number on the workstation (on the back bottom next to where the USB cord exits the workstation) to make sure it has been loaded into the teachWELD system.

It takes a long time to save a virtual weld.

The software must be connected to the internet to be able to pull down a diagnostic report. Due to the high volume of data being sent over the internet, it is always best to have a direct internet connection. If you are using wireless or a hotspot these times may increase for the weld to save as this may have weaker internet access available.

Why is the welding gun "out in space"

The welding gun has a "ghosting" look when the gun is not in the correct position. As you move the gun to the correct work angle, travel angle, and stick out distance, the "ghost" gun starts to disappear. This is an added feature that helps the user understand proper welding technique.

Gun on the screen does not move.

When you are in practice mode, make sure that the Inspection icon is not engaged. When looking at the Main Menu, make sure that the Main Menu is closed before trying a weld.

Welding gun jumps all over the screen when I get it close to the coupon.

If you see the gun jumping on the screen, there are two main issues that may be causing the problem. The first issue is calibration. Recalibrate the workstation and also the coupons. The second main issue may be interference. Check to make sure that you don't have metal objects that are close to the workstation. Due to the technology of the workstation, it needs to have a distance of about 3 feet from any heavy metal objects.

I log into my account and images are missing.

If you see images that are missing, the first option would be to logout and try logging in again. The second option would be to call product support to see if there is a server error or new software download that you have not uploaded.

What are the system requirements for the welding simulator?

http://www.realityworks.com/images/teachWELDspecs.pdf

Is "distance" and "stick out" terms used interchangeably?

Distance and stick out are the same; in this case what is being asked is distance from the coupon which is directly related

There is a rattling noise in the workstation.

The workstation is comprised of technology components that work directly with the computer and software. These electronic components when in use may make small amounts of noise. However, rattling noises in the workstation may indicate movement of the internal hardware. Always move and use the teachWELD workstation with care and if the rattle affects the usage of the system, please call product support.

Coupon becomes broken.

If your coupon is broken, please call Realityworks Product Support. We do have replacement pieces available for sale.

Can I delete a workstation from my list?

No, once you have added a workstation, it is there for future usage. The next time you plug in the workstation that has already been setup.

What is the difference between the WS** and WS****-Local?**

WS and WS-Local give two different pieces of information. For WS it shows a workstation that has not been calibrated, but rather is the factory default calibration. For WS-Local, it shows that the local workstation once plugged in, will go to the calibration settings of the last user of that workstation. So if you are a new user of that workstation you will want to use the WS and recalibrate to your specifications. If you are returning to the workstation and were the last to calibrate, you can use the WS-Local, as it is already set to your calibration specifications.

How do I find the workstation number if the serial number is missing from the workstation?

If the serial number is missing you will want to contact Product Support. They will have your serial number on file.

How many workstations can I have on a single computer?

Only one workstation works on a computer at a time, however, you can use any workstation on any computer as long as you go through the "add new workstation" process.

What problems could occur if someone were to enter the wrong WS SN when adding the WS and the number is recognized?

Each workstation is calibrated and then the calibration can be saved for that workstation. So if you use a workstation with the incorrect or wrong SN you will be getting the calibration for that other workstation. This could cause some issues when using the unit.

I need to order more student accounts, who do I contact?

You can contact our sales department at : 800.262.3806.

If I do not use all student accounts in a year, will they carry over to the next?

No, they are reserved for one year license, after the year is over they become null and void.

What are the system requirements for installation?

http://www.realityworks.com/images/teachWELDspecs.pdf

Where does the diagnostic info save to?

The diagnostic info saves to the Cloud. What this is an online server system held by Realityworks that allows students and instructors to be able to see all previous results.

Why do some of the welds say position is horizontal and one say flat when they are all horizontal welds?

Not all are horizontal, the t-joint and lap joint are horizontal and the v-groove is flat.

Will this work on Mac?

Not currently

Will instructors have the ability to change their own username and password? If they do, and if they forget is it a matter of us logging into their account profile and changing it ourselves?

Yes on both accounts

All other questions can be directed to Realityworks product support at 1-800-830-1416 or ProductSupport@realityworks.com.

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REALITYWORKS, INC. LIMITED WARRANTY

APPLICABLE TO THE FOLLOWING PRODUCTS: RealCareer teachWELD Simulator

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